NGINEERING LIBRARY

AUG 3 1950

The Engineer

VOL. CXC—No. 4929 28, ESSEX ST., STRAND, LONDON, W.C.2 JULY 14, 1950

Established 1856 Price 1s. 6d. By Inland Post 1s. 9d. Registered as a Newspaper

Now Standard
Timken double-thrust tapered-roller bearings, originally produced as 'specials', are now available in this standard light-weight type.
They have a high capacity for thrust loads, yet they can provide a considerable degree of radial stability as well. These features are being found of great value in an ever increasing range of applications.
Similar light-weight single thrust bearings are also standard. Both types are used successfully for oscillating motion and for continuous rotation.
Regd. Trade Mark : TIMKEN
TIMKEN
tapered-roller bearings
MADE IN ENGLAND
BRITISH TIMKEN LTD., BIRMINGHAM, & DUSTON NORTHAMPTON
Telephone: East 1321 Telegrams: "Britimken," Birmingham
Subsidiary Company : Fischer Bearings Company Ltd., Wolverhampton,
makers of FBC ball and roller bearings and transmission equipment

FROM MIXER TO SITE . . .
BY PIPELINE
UPHILL, DOWNHILL, UNDERGROUND & UNDERWATER

Blaw Knox concrete pipelines on the construction of the South Bank Concert Hall—Main Contractors—Messrs. Holland & Hannen and Cubitts Ltd.

Many contractors have found that the Blaw Knox Concrete Pump will eliminate wagons, chutes, hoists, towers, buckets, cranes and shovels AND REDUCE THE COST PER CUBIC YARD OF PLACED CONCRETE TO A NEW LOW LEVEL. Why not investigate the Blaw Knox Concrete Pumping System and see for yourself how significant an advance it really is. One man operation . . . speedier placing with no rehandling . . . easy to set up . . . extensible and adaptable . . . giving a steady flow of concrete uphill, downhill, traversing highways without obstruction to the traffic flow . . . tunnel lining undertaken without interruption to railway services . . . all these advantages and many more besides. Write for catalogue 101.

BLAW-KNOX CONCRETE PUMP

BATCHING, MIXING AND BULK CEMENT PLANT · CONCRETE MIXERS · MOTOMIXERS · CONCRETE PUMPS · CONCRETE SPREADERS AND FINISHERS
CONCRETE BUCKETS · STEEL SHUTTERING · ROADFORMS · DEWATERING PLANT · EXCAVATORS · LAND CLEARING EQUIPMENT · EARTH MOVING EQUIPMENT

BLAW KNOX LTD · 13 CLIFTON HOUSE · EUSTON ROAD · LONDON · EUSTON 5361

BKH

A Seven-Day Journal

British Cast Iron Research Association

MEMBERS' day of the British Cast Iron Research Association was held on July 5th at the Alvechurch headquarters. The President Mr. P. H. Wilson, made a brief speech of welcome and mentioned that building extensions had prevented meetings in 1948 and 1949. The first stage of the extension scheme, he continued, was now complete, and with a ceremonial cutting of the tape the President performed the official opening of the buildings. Taken over in 1942, Bordesley Hall (12 miles from Birmingham) has been slowly adapted for research work and it is planned ultimately to house all the laboratories external to the original building. The latest extension includes a new machine and instrument shop and a mechanical testing laboratory, together with certain domestic offices, and the President intimated that further expansion was contemplated and that the present staff, numbering eighty, eventually would be doubled. The members toured the laboratories and inspected the research work in progress, finding much to interest them in both old and new extensions. In the mechanical testing laboratory particular mention may be made of the tensile testing machine, which pulls specimens at —120 deg. Cent. and carries out a tensile impact test at —140 deg. Cent, and the creep testing machine. Propeller research with particular application to cavitation and corrosion is being actively pursued, a jet impact machine dealing with the question of cavitation erosion, while a Venturi apparatus investigates the formation and collapse of cavities. The latest addition to the activities of the Association is the development department which has been set up to assist in the application in industry of the results of research, to help with production problems, and to carry out investigations under actual rather than laboratory conditions.

The Chamber of Shipping

AT a Council meeting of the Chamber of Shipping of the United Kingdom, held on July 6th, the President, Sir Guy Ropner, commented upon several aspects of present-day shipping problems. He said that he was particularly glad to note that shipbuilders had now joined with shipowners in stressing the stultifying effects of present taxation, and expressed his constant astonishment at the Government's attitude. The shipping industry, he continued, contributed £100,000,000 towards the balance of payments, yet ship replacement was virtually impossible while 60 per cent of the profits was paid away in taxation. He went on to suggest that the solution of the problem might require some formal or direct action on the part of the Council. Another major problem facing British shipping was the growth of flag discrimination. The annual report of the Suez Canal Company was briefly touched upon and mention made of an application for a reduction in dues. He said that the revised draft of the international sanitary regulations, which aimed at security against the transmission of epidemic diseases, was under consideration by the Council.

An Exhibition of Industrial Power

As part of the Festival of Britain, 1951, there is to be an Exhibition of Industrial Power at Kelvin Hall, Glasgow, and on Monday last some details concerning it were made known by Mr. Tom Johnston, who is the Chairman of the Festival of Britain Scottish Committee. The exhibition, which is being organised by Mr. Alastair Borthwick, is designed to display outstanding British achievements in heavy engineering and its associated technologies, and, although it is to be located in Scotland, it will be just as much part of the national displays as the South Bank and Science Exhibitions in London. It will, like them, have a "narrative form," the exhibits being arranged round the central story of British contributions to the harnessing of power. The Exhibition of Industrial Power will not be a trade fair; the intention is to show the best examples of Britain's heavy engineering products displaying them where they are appropriate to the story. The exhibition will actually be staged through two main sequences, one starting from coal and the other from water. In the "Power of Coal" sequence the subjects covered will include mining, iron and steel, machine tools, power units from the time of Watt to the present day, the generation and transmission of electric power, railways and shipbuilding. In the "Power of Water" sequence there will be demonstrated hydro-electricity, civil engineering and irrigation. A final section will deal with nuclear energy as the source of power of the future. The exhibition, it is stated, will not only show machinery and the techniques adopted for making it, but will demonstrate also the effect of heavy engineering on the daily life of the nation.

An Agricultural Engineering Course

THE College of Aeronautical and Automobile Engineering, which is situated at King's Road, Chelsea, S.W.3, has announced this week its intention to open in the autumn a Department of Agricultural Engineering which will provide a comprehensive practical and theoretical training course in agricultural engineering. Part of the plan will be to train students for the examinations of the Institution of British Agricultural Engineers, details of which, we understand, are now being prepared. There is still a great shortage of agricultural engineers, and the Chelsea College is starting up this new department to help meet the demand for specialised engineers which arises from increased agricultural mechanisation. The syllabus for the course includes practical and theoretical training in all forms of internal combustion engines and agricultural machinery, and practical work in engineering and electrical workshops and in the drawing-office. The theory section will deal with engineering science, geology, crop and animal husbandry, and the economics of farm machinery. The course will take up eighteen months, the final period being spent with operators of agricultural machinery and on farms to obtain experience of equipment under actual working conditions. Students who already have some engineering experience, however, will be able to complete the course in less than eighteen months.

Electricity Load Spreading

THE Minister of Labour, Mr. G. Isaacs, stated last week that the arrangements for spreading the industrial electricity load next winter had been considered by the electricity sub-committee of his National Joint Advisory Council, and recommendations made by that Council had been accepted by the Government. Mr. Isaacs said that, despite great efforts to expand generating capacity, the increase in demand during recent years had generally been such as to offset the increased supply of current. The expansion in generating capacity was now beginning to overtake the increase in demand, however, although it was estimated that there would still be a substantial deficit during peak periods next winter unless consumers took special steps to reduce the load. But he felt that the arrangements recommended should prove less onerous than those in force last winter. During next winter, the Minister continued, the peak hours for industry would be confined in the morning to the period 8 to 9.30 a.m., although care in the use of electricity would still be necessary up to noon. During the hours of 8 to 9.30 a.m. for the months of December, January and February, it was recommended that a reduction in load of at least 10 per cent should be required of industry. The afternoon peak hours would remain unchanged at 4 to 5.30 p.m., when a similar reduction of at least 10 per cent would be required during the period December to mid-January. Mr. Isaacs added that the Regional Boards for Industry would again have general charge of the administrative arrangements. In view of the inconvenience and difficulties caused to employers and workpeople last winter by the staggering of hours, the Boards were to be asked to pay special regard to the need for avoiding that method of load spreading.

Planning and the Iron and Steel Industry

THE suggestion that there were "too many planners chasing too many theories without consideration of even the basic factors of such planning," was made by Mr. Clive Cookson, chairman of the Consett Iron Company, Ltd., at the annual meeting on Monday last. Mr Cookson said that he had little doubt that the steel industry would exceed the Government "forecast" of an output, during this year, of between 15,750,000 tons and 16,000,000 tons, provided the increased quantities of raw materials, ore, coal, coke and scrap could be obtained. It was a constant struggle by all concerned, Mr. Cookson continued, to provide adequate supplies especially of coking coal and coke, and there was also a world shortage of ore. Yet, he observed, it was not so long ago that some public men and economist planners, in their attempts to build up any sort of a case for nationalisation, criticised the iron and steel industry most severely for not planning to reach, by 1953, the ridiculous output figure of 20,000,000 tons and even 26,000,000 tons annually. Like so many plans made by theoretical planners, he added, their chief basis seemed to be nothing more reliable than their own assumptions!

British Non-Ferrous Metals Federation

THE British Non-Ferrous Metals Federation held its annual meeting in Birmingham on Thursday, July 6th, and re-elected Mr. W. H. Henman as President for a second year of office. Following the requirements of the constitution, the President, in place of the normal Presidential address, made a report on the Federation's activities during the year, a report that was of particular interest in view of the fact that Mr. Henman has just completed fifty years' active work in the non-ferrous metal working industry. He said that the spirit of co-operation, understanding and mutual help which characterised the relations of firms in the industry to-day would have appeared a little curious to many of their ancestors fifty years ago. The exchanges of technical information, the comparison of experiences, and the willingness to help which were everywhere evident to-day were, he considered, very largely, if not entirely due to the growth of the trade association movement and to the excellent work done by those associations in the last two or three generations. Mr. Henman then went on to speak of the present cost of non-ferrous metals, deploring the fact that, five years after the end of the war, the wartime system of bulk purchase still prevailed. There was, he observed, every reason for alarm at the high level of costs to-day, especially when it was borne in mind that the element of raw material accounted for anything up to 90 per cent of the cost of the articles which the non-ferrous metal working industry sold. It was an inescapable economic law that where the price of an article remained for a long period substantially out of relation to the price of its potential substitutes that the user was bound to turn to such substitutes. Mr. Henman said that he could not emphasise too strongly the Federation's view that the prices of copper, zinc and other non-ferrous metals should come down to a more reasonable level at the earliest possible moment.

North of Scotland Hydro-Electric Schemes

AN INTRODUCTORY SURVEY

FROM time to time in these pages we have briefly described the numerous schemes of the North of Scotland Hydro-Electric Board for harnessing the water resources of the Highlands and for distributing electrical energy. Although many of the schemes are not yet beyond a preliminary stage, those which form the first part of the programme are approaching completion, and a stage has now perhaps been reached when a rather more comprehensive account of the origin and work of the Board may not be out of place.

Scarcely any part of Scotland is more than 50 miles from the sea. In spite of high rainfall in some districts, the rivers are not of the size associated with large-scale Continental and American hydro-electric works, so that the Scottish works may seem small by comparison. Yet more than one hundred separate schemes at present are scheduled for construction, with a very considerable aggregate of power—in fact, power greatly in excess of Scotland's own requirements. A study carried out in 1944 by the Board estimated that in addition to some 1½ million kWh already developed, about 6300 million kWh of hydro-electric energy could be produced annually in the Highlands. By extension of the principle of trapping and diverting water from one watershed to another, even this figure for potential output could, it was thought, be increased substantially. It is interesting to note that the figure of 6300 million kWh represents about one-seventh of the total electric power demand in the whole of Great Britain and that if it were attained, it would make a handsome contribution to power requirements.

Early Scottish Hydro-Electric Works

The first hydro-electric station in Britain was opened more than fifty years ago, in 1896. It was built at Foyers, in Inverness-shire, by the British Aluminium Company. A second station was opened in 1909 by the same company in north Argyll, at Kinlochleven. Fifteen years later, in 1924, the company carried out a third development, the Lochaber power scheme. All three of these schemes, whose total installed capacity is slightly in excess of 100MW, utilised the power at a high load factor for the manufacture of aluminium, an industry which flourishes on cheap electricity.

No scheme for hydro-electric power for general use was sanctioned until 1922, when the Grampian Electricity Supply Company was authorised by Parliament to carry out works totalling some 85MW in the central Highlands. These schemes did not come into operation until 1930 and 1932, but in the meanwhile the first Scottish hydro-electric station for public supply was opened by the Lanarkshire Hydro-Electric Power Company, at Bonnington and Stonebyers Falls, on the River Clyde. The important Galloway scheme in south-west Scotland, authorised by Parliament in 1929, came into operation in 1935 and 1937, with a total installed capacity of 103MW. The five power stations of that scheme utilise the whole catchment of the River Dee, in Kircudbrightshire, to which are also diverted the headwaters of the Ayrshire River Doon. Between the passing of the Grampian Act in 1922 and the formation of the North of Scotland Hydro-Electric Board in 1943, no further schemes were approved by Parliament.

Opposition to Hydro-Electric Developments

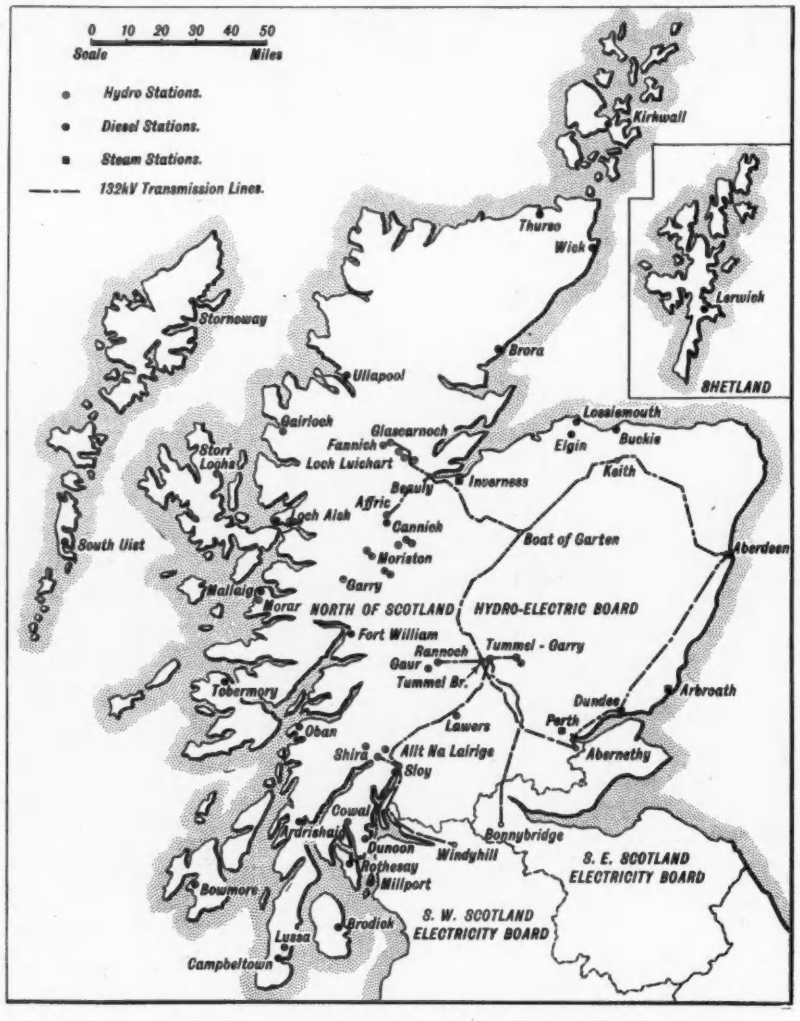
It seems hard to understand why hydro-electric power should not have been extensively developed in Scotland at a time when such developments were being pushed ahead throughout the world and in many cases planned and carried out by Scottish engineers. Perhaps the main reason why early use was not made of water power was the cheap and plentiful supply of coal which for more than one hundred years formed the basis of Scottish heavy industry. Later, hydro-electric schemes were increasingly opposed by a variety of interests.

Opposition came from the coal interests, possibly from fears that hydro-electric competition would lead to unemployment and loss of interest on capital invested in the coal-mining industry. Strong opposition also arose from fears of harm being done to salmon and trout fishings in the lochs and rivers and from apprehension that beautiful scenery would be marred. Quite apart from æsthetic grounds of opposition, there were the economic reasons that Scottish fishing and scenery between them attract visitors and that the fishing is an industry of some importance.

Such was the strength of the opposition that it began to seem impossible for any hydro-electric project in the Highlands to receive Parliamentary approval. Even in 1941, when the need for additional supplies of electricity was pressing, Parliamentary sanction was withheld from a scheme which had already received the favourable report of a Parliamentary commission. Mr. Thomas Johnston, then Secretary of State for Scotland, nevertheless appointed a special committee, of which Lord Cooper was the chairman, to consider the best method of utilising Highland water power.

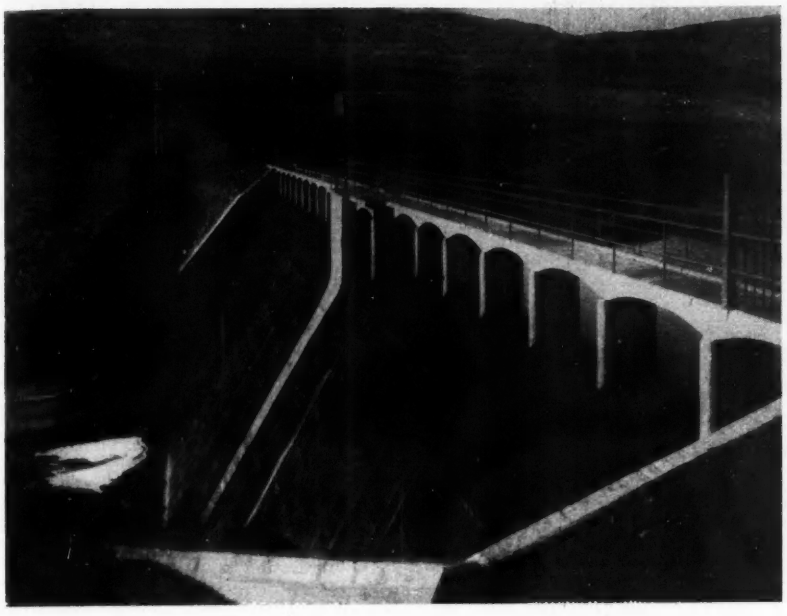
Cooper Committee

The Cooper Committee was unanimous in recommending full co-ordinated development of the Highland rivers. It pointed out that the potential resources vastly exceeded the maximum predictable demands of the Highland area, and it therefore suggested that while Highland demands should have priority, electricity surplus to those needs should be sold to the Central Electricity Board



NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD AUTHORISED STATIONS

(now the B.E.A.). Since large-scale hydro-electric stations can produce electricity more cheaply than can be produced by steam generation, then, provided a reasonable market price were secured for the surplus, a profit would be available whereby the uneconomic distribution of electricity in the Highlands areas themselves could be financed. As the Cooper Committee pointed out, Highland depopulation had already gone so far that even if electricity were generated free, its cost of transmission and distribution to the scattered crofts and hamlets would make it impossible for it to be sold at a price which the inhabitants and small industrial users could afford, without a subsidy so large as to be outside the range of practicable possibilities.



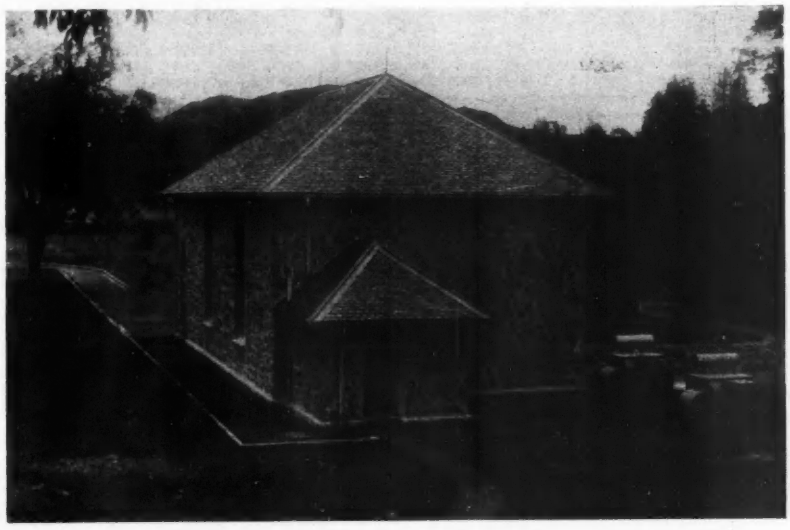
LOCHALSH DAM

The Hydro-Electric Development Act

On August 5, 1943, the Hydro-Electric Development (Scotland) Act was passed by both Houses of Parliament without a division. It gave effect to all the main recommendations of the Cooper Committee and established a new public authority, the North of Scotland Hydro-Electric Board, to be responsible for all future hydro-electric development in roughly the north-western two-thirds of Scotland, where the great bulk of the undeveloped water power resources of the United Kingdom are situated. The Act also placed upon the Board the obligation of distributing electricity in all the remote parts of the Highland area outside the regions in which authorised electricity undertakings were already operating. The Board had to pay its way and, therefore, a guaranteed market for an exportable surplus was provided in a clause inserted in the Act by the Secretary of State for Scotland.

The Act lays down procedure to be followed before any constructional scheme can proceed. The scheme must first be submitted to the Electricity Commissioners, who satisfy themselves that it is technically and financially sound. After this scrutiny the scheme is "published." Forty days must then elapse before it can be "confirmed," and during that time objection can be lodged with the Secretary of State. If circumstances so require, the Secretary of State may order a public inquiry to investigate the desirability of the scheme in the public interest. If the Secretary of State decides to confirm the scheme, it must then lie before Parliament for forty days more. During that period a Prayer for its annulment may be presented and a debate held; if not, the scheme automatically becomes law at the end of the second forty days' period.

The Act also gave power to the Secretary of State to appoint a Fisheries Committee and an Amenity Committee to advise him and the Board on the preservation of fisheries and scenic amenity in connection with the construction of all hydro-electric schemes.



NOSTIE BRIDGE POWER STATION—LOCHALSH SCHEME

In addition to having the advice of the two statutory committees, the Board retains its own specialist advisers and consultants to give day-to-day advice on points of detail.

In view of the somewhat special function of the North of Scotland Hydro-Electric Board, it was not amalgamated with the British Electricity Authority when the Electricity Act of 1947 came into effect on April 1, 1948. The Board retained its comprehensive power to generate, transmit and distribute electricity over an area of 21,750 square miles (about 74 per cent out of the total area of Scotland), functions now undertaken jointly in other parts of the country by the British Electricity Authority and the area Boards.

Amenity

Inevitably, the construction of large-scale hydro-electric works causes changes in the landscape. These changes may affect wild life, particularly the salmon and sea trout, which go up the rivers from the sea to breed in the gravel of the headwaters. Dams without special arrangements may prevent fish from reaching their breeding-grounds and changes in river flow affect the food supplies for the young fish before they migrate to the sea. But the Board feels confident that its operations will not materially affect the assets on which Scottish opinion sets such store. Indeed, in some respects several of the schemes now planned or under construction include provisions for improving the existing fisheries, and for opening up new stretches of water favourable to fish-breeding and for the establishment of fish hatcheries. As to alterations in the landscape, very great care is being taken to ensure that works are sited with care and forethought and are of dignified and artistic design.

Rainfall, Storage, Catchment

Rainfall in Scotland varies greatly from year to year and from month to month; it also varies greatly with the locality. At Loch Quoich, one of the tributaries of the River Ness, the annual average rainfall at a point 750ft above sea level is 146in. A rain gauge there recorded over 213in in 1938, and the annual average on the neighbouring hills exceeds 200in. At Loch Sloy 168in of rain were recorded during 1948. Yet the Moray Firth district, into which the River Ness flows, has an annual average rainfall of less than 24in, combined with a remarkably high record for sunshine.

The rivers flowing from the areas of high rainfall are "flashy" streams. On a typical Highland river the summer flow may fall to one-fifteenth of the average flow, and a winter flood may rise to twenty times the

average. Scottish rivers differ in this respect from rivers of countries where there are glaciers and extensive snowfields, which help to maintain the flow in warm and dry weather. For these reasons it is essential in most of the Scottish schemes to have reservoirs with large storage capacities.

It is a surprise to many to learn how difficult it is in the Highlands to find suitable sites for large dams. The reason for this difficulty is the extent of the glacial moraine, which is pervious to water. Although the Highlands appear to be richly provided with narrow valleys and gorges, where the surface contours suggest that dam construction would be straightforward, the number of sites where solid rock foundations exist for a large dam are comparatively few. The preparation of a scheme is therefore often governed by the possible locations and extents of storage reservoirs, and dams are in general gravity or buttress designs. Given a suitable site for storage, with the highest practicable operating head of water, it is usually necessary to increase the natural catchment area by aqueducts and tunnels from other catchments above the level of the chosen reservoir.

TABLE I—*Particulars of Hydro-Electric Stations of Schemes Authorised or Published*

Station	No. of sets and kW capacity	Total kW capacity	Catchment area/square miles	Gross head, feet	Average rainfall per annum, inches	Annual output (millions of kW hours)
Sloy	Four 32,500	130,450	32·5	910	115/120	120
	One 450	—	—	—	—	—
Lochalsh	Two 500	1,000	7·3	490	68	4
Morar	Two 300	600	65	16	100	2
Pitlochry	Two 7,500	15,000	706	50	55	54
Clunie	Three 19,000	57,000	515	173	60	143
Errochty	Three 25,000	75,000	86	610	55	103
Gairloch	One 400	600	13	400	76	3
Fannich	Two 12,000	24,000	56	537	79	83
Cowal	Two 3,000	6,000	15	400	80	14
Affric	Three 22,000	66,000	124	522	108	236
Shira (upper)	One 5,000	45,000	13	160	112	80
Shira (lower)	One 40,000	—	21	965	112	—
Lussa	Two 1,000	2,000	13	380	67	8·5
Storr Lochs	Three 800	2,400	5·2	147	75	5·5
Gaur (1st stage)	One 5,000	5,000	93	92	69	17
Glascarnoch	Two 12,000	24,000	102	529	74	112
Luichart	Two 12,000	24,000	329	185	76	124
Torr Achilty	Two 7,500	15,000	345	52	74	36
Achanalt	One 2,000	2,000	73	65	77	8
Quoich	Two 10,000	20,000	52	320	125	68·0
Invergarry	Two 12,000	24,000	151	218	100·8	102·5
Caennacroc	One 4,000	17,500	79	296	98	70
	One 13,500	—	—	—	—	—
Doe	One 900	2,700	15·0	215	94·0	7
	One 1,800	—	—	—	—	—
Dundreggan	One 13,000	13,000	134	118	86	45
Invermoriston	Two 10,000	20,000	158	188	82	75
Livishie	One 6,000	6,000	14	980	61·0	17
Lawers	One 30,000	30,000	17·5	1,362	87	71
Lairige	One 6,000	6,000	5·4	810	112	17·5
L. Dubh (Ullapool)	Two 300	600	5·1	515	62	1·5
Total	—	634,850	—	—	—	1627·5

SITUATION AND SIZE OF PROJECTS

The accompanying map and table indicate the situations and main features of the constructional schemes at present published or authorised by the Board. Sixteen constructional schemes, containing nineteen projects for the generation of electricity, have so far been published. These schemes cover the construction of twenty-nine hydro-electric stations containing fifty-six turbo-alternator sets, with a total capacity of approximately 630MW, and an annual output of nearly 1700 million units, equal to 42 per cent of the present consumption of electricity in the whole of Scotland. The largest turbine is of 53,500 h.p. coupled to an alternator of 40MW capacity, and the smallest is a 200kW machine. Operating heads vary from 1362ft in the Lawers project down to 16ft in the Morar scheme. The turbine types cover vertical and horizontal Francis, vertical Kaplan and horizontal Pelton wheel machines. The largest Kaplan turbine is of 18,500 h.p., coupled to an alternator of 13MW capacity, and the largest Pelton unit is rated at 40,500 h.p., driving a 30MW alternator.

In addition to the schemes already promoted, the Board has under examination for future development a number of other schemes, which will have an annual output of over 1000 million units, with a plant capacity of about 300MW. The Board also has under construction a "Highland grid" to connect its various generating stations and linking with the British Electricity Authority's grid on the outskirts of Glasgow (Windyhill) and at Bonnybridge. The pressure of the main transmission scheme does not at present exceed 132kV.

These constructional schemes serve to illustrate the types of project the Board is developing throughout the Highlands. Export sale of electricity, surplus to Highland requirements, from major schemes such as those at Loch Sloy and in the Tummel-Garry districts permit the Board to carry out the uneconomic rural distribution schemes in the remote areas. Many of these rural distribution schemes have already been completed and others are following. Rather than wait until a local hydro-electric scheme has been constructed, the Board has in several districts given a supply without delay by installing temporary diesel plant. (See map.)

STATIONS IN OPERATION

The first of the Board's hydro-electric stations—one at Morar and the other at Lochalsh—were officially put into operation on December 21, 1948. The Morar project supplies 71 square miles of an isolated part of the western seaboard of Inverness-shire, extending from Mallaig to Kinlochailort. The scheme provides for raising the level of Loch Morar by 8ft, but the present stage, involving a weir with an automatic drum gate across the River Morar above the falls, limits the increase to 3ft. Two 300kW Kaplan turbines operate under a head of 16ft and are situated in a power station hewn out of the rock on the south bank of the River Morar. The scheme can be extended to a capacity of 2000kW and the production of 6,000,000 units annually, by making use of the full head to sea level, but is at present limited to 600kW.

The Lochalsh project provides electricity supplies to an isolated part of the mainland of Ross-shire and the south-east of the Island of Skye. The scheme is capable of being developed up to a capacity of 4000kW by the construction of a second dam, but at present it consists of one dam, a mass concrete gravity structure 56ft high and 250ft long, and a generating station of 1000kW capacity, comprising two 500kW horizontal alternators coupled to "Turgo" impulse turbines. The gross head is 490ft and water is conveyed to the power station at Nostie Bridge by a pipe-line nearly a mile long. The dam and power station of this project are shown in the accompanying illustrations.

Power production at Loch Sloy, the first of the Board's major schemes, commenced on March 6th of this year. Only one of the four principal machines in the power station of this scheme at Inveruglas is at present in use, however, since the scheme is only partially completed. It is expected that the three remaining machines will be brought into operation during the summer. The Loch Sloy scheme will be described in greater detail in our next issue.

The Tummel-Garry and Fannich schemes have also reached an advanced stage of construction and the first machine completed in the Tummel-Garry scheme, at Clunie power station, was turned round on February 12th and was subsequently brought to its full load of 19MW on April 8th. The two other 19MW generators in Clunie power station will be brought into service successively and will be in operation before next winter.

A number of generating stations were transferred to the Board when the Electricity Act came into operation in 1948, including the hydro-electric stations at Loch Luichart, Rannoch and Tummel Bridge, and several steam and diesel stations. Thus, the total capacity of installed plant at the Board's stations is now more than 250MW, in addition to the plant at the Sloy and Tummel-Garry projects.

FUTURE SCHEMES

Recent investigations and surveys of further hydro-electric schemes which have recently been announced in the Board's Annual Report for 1949 include proposals for schemes to use the waters of Loch Shin, the Rivers Orrin, Giorra, Lyon, Lochay, Lednock, Earn and Oude, and the Falls of Mucomir. The Shin and subsidiary schemes in Sutherland will have an estimated output of about 164 million units and a plant capacity of about 44MW. The Orrin scheme will be part of the Conon Basin group of schemes, which include the Fannich and Glascarnoch-Luichart-Torr Achilty schemes in Central Ross-shire. It is proposed to use the head waters of the Rivers Lyon and Giorra and streams in Glen Lochay and Glen Dochart, in Perthshire, in a scheme

Table II.—*Schemes under Survey*

	Approximate total MW capacity	Estimated annual output (mill. of kW hours)
Orrin	18	74
Lyon-Lochay	60	195
Lednock-Earn	25	87
Mucomir	1·5	9
Oude	3	9
Shin	44	164
Luib	5	15
Further schemes under preliminary survey	253	883
Total	409·5	1436

to be called the Lyon-Lochay scheme. The Lednock-Earn scheme is designed to operate on water from the high catchment area which lies between Loch Tay and Loch Earn. The Oude near Oban in West Argyll and the Falls of Mucomir near Fort William in Inverness-shire are designed to supply local demands.

The total output and the capacity of all schemes, those under construction, those on which work has not begun and those which have been under survey, are 1,041,750kW and 3,017,500,000 units.

Research

Apart from the supply of electricity, the Board's programme at present includes a number of interesting items of research work. Tests for the generation of wind power have been carried out in conjunction with the British Electrical and Allied Industries Research Association on two exposed hilltops on the Orkney Islands, and the Board has decided to build in Orkney a windmill for the generation of electricity, which will have a diameter across the blades of about 60ft and an output of about 100kW. This windmill will be erected at Costa Hill, and it is hoped that it will be ready for running trials by the end of this year.

Other research work is being carried out in connection with freshwater fisheries. The development of minerals and other raw materials of the Highlands by the use of electricity, and various other subjects, are being investigated, and experimental work is well advanced in connection with the construction of a special heater to be fired by peat fuel, which will be used in conjunction with an experimental closed-cycle gas turbine. This work is being carried out under the general direction of the Board at the works of John Brown and Co., Ltd., Clydebank, and it is hoped that the experimental heater will be ready to function by the close of this year.

Institution of Naval Architects

JOINT SUMMER MEETING IN NEWCASTLE

No. II—(*Continued from page 17, July 7th*)

THE second paper to be read at the meeting was :—

RESEARCH ON DESIGN OF DRIFTERS

By James F. Allan, D.Sc.

Synopsis

Four models were prepared for tank testing; model "O" was made to the lines of a drifter, model "A" retained the same dimensions but with finer entrance and fuller 'midships and L.C.B. further aft, model "B" had dimensions and form freely altered, and model "C" was model "B" with 1ft more beam. All the models, correctly ballasted, were tank tested and the E.H.P. calculated. Models "O," "A" and "B" underwent self-propulsion tests and later self-propulsion tests among waves of varying lengths and heights, heave and pitch, were observed. The results are shown both graphically and in tabular form and point the direction to modification in design to effect improvement in the speed of herring drifters without sacrificing sea-going qualities.

A film illustrated the paper clearly, showing the behaviour of the models among waves.

Discussion

Mr. R. W. L. Gawn said the investigation was a convincing example of the value of ship model research. The design, which had a decided advantage as regards resistance of the model in calm water, had more than maintained that advantage in the propulsive tests, and was as satisfactory as regards motion and dryness when head on to waves, and this was confirmed by ship trials. That was reassuring confirmation of the value of resistance tests in calm water, but did not imply that the form deduced from calm water tests could always be relied upon as the best for rough weather.

Data given showed a remarkable reduction in the resistance of the fine model form "C," and the author had attributed that to the fine entrance and hollow water line. Actually the sequence of resistance of the four models was exactly in accord with the changes in prismatic coefficient, so that the improvement of form "C" should be attributed to the favourable prismatic coefficient. Reduction of prismatic coefficient as in form "C" led to other changes in form, in addition to the finer entrance and hull lines, the change in lines being a consequence of the increase of midship section area.

The first paper to be read on Wednesday morning, June 28th, was :—

SURFACE FINISH OF MARINE ENGINE PARTS

By Professor A. S. T. Thomson, Professor A. W. Scott, and Mr. W. Ferguson

Synopsis

The paper presents the results of a preliminary survey of machined surfaces being produced in marine engine shops. The firms selected supplied samples of cylindrical and flat surfaces, which were examined for roughness by Talysurf and Tomlinson recorders. Roughness and waviness are considered and the records of both instruments compared for various finished surfaces. A survey of the results indicated a considerable variation of finish, especially with a particular tool, and that emery polishing after scraping gives a high degree of finish. The second part of the paper describes experiments to secure uniformity of surface finish by using a standard tool; each sample was wet-scraped then part was emery polished and a third section part-honed. Records of the surfaces are examined and the improvement effected by emery polishing and by honing is clearly demonstrated and also the variation in finish between the wet-scraped surfaces.

Discussion

Dr. Livingston Smith said the work was put in hand by the Research Association to ascertain the range of surface finish actually used in practice, in order to establish a basis of bearing pressures and shrink fits.

The variation between the surfaces supplied by different firms, he said, indicated that either money was being wasted in producing an unnecessarily good finish or the best finish for a particular purpose was not being obtained. Opinions differed as to the best finish for a particular duty and it was hoped to find answers to the problem in respect of certain engine parts.

The high degree of finish obtainable by emery polishing after scraping and also by simple methods of honing was important to the marine engineering industry. One firm, he said, had investigated methods of finishing the surface of crosshead pins for a diesel engine and best results were obtained by using emery cloth. By adopting this the firm had eliminated the lapping process, saving both time and expense. That was an example of research which paid early dividends.

Mr. Harry Hunter emphasised the importance of the measurement of fatigue in machine parts, and asked whether the programme of work included such measurements.

Questioning whether the measurement of axial variations was really what we were after, Mr. Hunter said that in oscillating bearings the white metal would accommodate itself to axially measured imperfections, but not to circumferential imperfections. For oscillating bearings we must have fine finish, but there were different kinds of fine finish and perhaps we were learning now the kind of fine finish required. He suggested that circumferential measurements were wanted in rotating and oscillating bearings and in rotating bearings the feed factor would come in.

Mr. Ferguson replied that the problem of roundness in connection with the assessment of cylindrical surfaces was a problem still to be faced; there were some laboratory methods of measurement, but they required very special arrangements.

The oscillating case would still give trouble because in any surface produced in a lathe there was the effect of the feed, and we did not get the full effect of the valleys and the tops of the ridges.

The next paper, on Wednesday morning, was :—

A NEW CARGO LINER DESIGN

By E. H. Watts

Synopsis

This paper is not a detailed description of a new type of ship. Nearly everything unusual in the design is consequential upon the decision to concentrate strength on the weather deck. Existing international conventions, which govern construction and lay-out of ships, were not practicable to the design. The Ministry of Transport, the British shipowners, and the representatives of the Navigating and Engineer Officers Union and National Union of Seamen decided to support the venture. An amendment to legalise the position received the unanimous agreement of the Government, owner and employee groups, respectively, at Geneva. This allowed the "W" boats to be specially registered under the British flag.

The ships are required for the Eastern Canada/Continental cargo liner service. The intention of the design is to meet the worst conditions at sea, and the most difficult berthing in any of the ports to be visited.

First, the author has set out the "appreciation" of the shipowners' problems.

Secondly, he turns to some of the innovations which were deemed necessary to overcome the difficulties of the trade. Ideas have been freely borrowed and adapted from other industries.

Finally, the paper is written before the ships' data are complete. It is better thus, so that the story of the aims and endeavours is told whilst hopes are only partially realised and errors have yet to be assessed.

Discussion

Mr. H. E. Skinner said it was a grand thing for the shipowners to indicate the kinds of ships they liked, so that naval architects, shipbuilders and engineers might know how best to satisfy the requirements.

Mr. Watts, he noticed, had made no reference to tonnage, a very important factor influencing the design of the ship described, and said that for her size she had about the smallest gross and net tonnage of any ship in existence! By introducing a 'tween deck height of something like 15ft. 6in the shelter deck had been put very high above the load water line and he believed that introduced the problem of stability. Figures showed that the metacentric height in the homogeneous cargo condition was 2ft; it seemed rather an ample margin

and he asked whether the 2ft was for the arrival or the departure condition, and whether it included corrections for free surface, for it seemed that the ship had rather more beam than was customary for ships of her length.

The tonnage regulations, he continued, would not allow the ship to be sub-divided to withstand war damage. If the bulkheads extended above the main deck it would be necessary to cut holes in them in order to obtain the maximum benefit from tonnage regulations. Although the ship had nine water-tight bulkheads, two more than Lloyd's requirements, she was not well sub-divided against damage. Mr. Skinner pointed out that by carrying certain bulkheads up to the shelter deck, any one of the three parts into which the ship had been divided could be completely flooded, without sinking the ship. He emphasised that the regulations were framed in such a way that the designer was penalised in providing maximum safety, together with the best operating conditions.

Mr. Ernest M. Morley commented on the many novel features in the ship and said that Mr. Watts had evolved a ship which was suitable for one of the most rigorous of all trades, namely, the North Atlantic.

The two maritime organisations, he stated, had jointly approached the Ministry of Transport to grant the necessary dispensation to enable Mr. Watts's vessels to incorporate certain features of accommodation which did not comply with the regulations and the necessary clauses were included in the Convention by international agreement.

Mr. Morley said that by placing the accommodation inboard and providing for a circulation of air between it and the ship side he believed sweat would be eliminated.

Professor E. V. Telfer, dealing with the point that the knuckle design contributed to keeping the ships afloat after being torpedoed, assured Mr. Watts that the knuckle as shown in a model of the M.V. "Wanstead" could not possibly have kept a ship afloat either forward or aft.

Mr. Watts had quoted a service speed of 14·86 knots on 17·6 tons of diesel oil and a propeller slip of 0·87 per cent, corresponding to average Atlantic weather, and he asked how many voyages were averaged. By taking five or six voyages as a minimum, the slip would increase to something like 4 or 5 per cent and the Admiralty constant would be possibly 275. He asked whether the figure given in the paper (301) was the shaft or indicated Admiralty constant, and also asked for details of Mr. Watts's experiments on bilge keels.

Mr. Tanner endorsed Mr. Morley's remarks concerning accommodation and said that the promenade along the ship's side permitted the crew to take exercise below during bad weather on the North Atlantic. The ventilation was also very good.

Mr. Mungo Campbell referred to the omission of any reference to tonnage and called attention to the danger of shelter deck ships having no 'tween deck bulkheads.

Stressing the importance of the longitudinal distribution of weight from the point of view of sea kindliness, Mr. Campbell recalled that a ship carrying concentrated iron ore proved more comfortable than that with a coal coargo.

Commenting on the fine crew accommodation, he pointed out that the standard of accommodation in ships was becoming far above the standard at home. The capital charges of the ships, he continued, could not be overlooked and that there must be reason in these matters, and we could only compete provided the rest of the world adopted similar standards.

Mr. John Liddell said that if war broke out the necessary arrangements to give effective sub-division could be put into operation.

On the question of stability he said that the Ministry of Transport would not allow for the filling of tanks at sea. The G.M. of 2ft related to the departure condition, and after allowance was made for the fuel consumed, the G.M. in the arrival condition was sometimes 0·5ft or 0·25ft, so that there was no need to fill tanks at sea.

He stated that asbestos spraying had been adopted to prevent sweating of the underlining of the accommodation and asked Mr. Watts how the crews reacted to internal cabins.

Mr. Liddell mentioned that the net registered tonnage was very low, being about 2800 tons.

Mr. A. Hiley referred to the propeller shaft being accommodated in the stern post, which was a departure of significance.

He noted that in the full ballast condition the propeller immersion was 2ft, and suggested using a smaller and faster-running propeller, thereby gaining more immersion, though at the loss of smooth water efficiency.

Mr. Watts, in his reply to the discussion, said that shipowners often made the mistake of specifying deadweight, and this raised problems. He did not very much mind, within 500 or 600 tons, how much the ship carried, being more concerned about seaworthiness.

Enlarging on the question of the G.M., he said that in the North Atlantic the ships took a lot of spray over the bows. This froze at 26 deg. Fah., so that a ship might have 200–300 tons of frozen spray on the upper works and he had suggested a G.M. of 1ft 8in on departure.

With regard to bulkheads, he had in mind what would have to be done in time of war and that was one reason for the provision of side doors, which were fixed at a height to enable them to take the ships alongside at Toronto and use the pallet system.

He justified the increased strength of the upper deck by quoting the small damage sustained by the "Wanstead" in a collision.

Dealing with Professor Telfer's comment concerning the knuckles, he said the "Woodford" was the seventh ship so fitted and gave details of four ships which were torpedoed but made port.

Continuing, he said the ships were specially strengthened forward to cope with pack ice and the value of such provision had been demonstrated when one of the ships had run aground in the St. Lawrence and had been set up only 1½in in No. 1 hold.

(To be continued)

Telescopic Gangways for New Ocean Terminal, Southampton

AT the new Ocean Terminal now under construction at Southampton Docks, there will be three telescopic gangways which will provide covered walkways between the first floor of the three-storey building and liners at the quayside. These gangways have been built by Structural and Mechanical Development Engineers, Ltd., of Slough. They will be used instead of the normal gangways which are considered undesirable particularly when high winds are blowing. It is also felt that the familiar type of gangway is out of character with the nature of the luxury liners using the terminal and the new building itself.

Three complete gangway units are being constructed by the firm. Each consists of a shore station, which can be traversed along the side of the terminal building, carrying two telescopic gangways which can be slewed, luffed, extended and retracted by mechanical means. Not only will it be possible to move the gangways along the quay to the correct positions opposite a ship's entry doors, but, once connected, the walkways will be free to move upwards and downwards to suit tide levels and to rotate sideways to meet fore and aft movement of the ship. When they are not required the two gangways of each unit can be swung back against the side of the building to leave the quay clear for cargo crane operation.

When the gangways were ordered the specification called for units to take, when extended, a working load of 200 lb per foot of walkway combined with wind pressures corresponding to 50 miles an hour. As the extended ends of the walkways cantilever out 75ft clear of the outer supporting rail at the landwards end, it will be appreciated that considerable forces had to be taken into account when designing the mounting turrets, the shore structure and the operating gear. Aluminium alloy was chosen for the structural material in order to minimise the load on the shore structure and to keep the size of the operating mechanism within reasonable limits.

The leading particulars of each of the gangway units as constructed are as follows :—

Shore Housing :			
Length			26ft
Width			20ft
Height			16ft
Weight			9 tons
Gangways :			
Outer :		Inner :	
Length	40ft	Length	43ft
Width	4ft 6in	Width	3ft 9in
Height	8ft	Height	7ft 6in
Weight	30 cwt	Weight	30 cwt
Total length, extended			68ft
Traversing speed			1 m.p.h.
Slewing speed, time for 90 deg. movement			57 seconds
Luffing speed, time for 20 deg. above to 20 deg. below horizontal			46 seconds
Telescoping			6·65ft per second
Traversing motor			8½ h.p., 1440 r.p.m.
Telescoping motor			4 h.p., 1420 r.p.m.
Hydraulic Pump motor			12 h.p., 960 r.p.m.

The Shore Housing Structure

As can be seen from one of our illustrations, the shore housing is a space frame carrying two turrets on which the gangways are mounted. This housing transfers the loads imposed by the weight of the gangways and turrets and those due to wind reactions to transverse wheels which run on upper and lower rails of the building platform. Two road wheels on the turret side of the structure run on the lower platform rail and rollers at the upper part of the rear of the structure move along an upper rail.

The structure consists of two side frames held apart by a series of girders and portal frames. The first girder, which is held vertically above the turrets, carries the housings for the top turret journals and thrust races. It is braced by a horizontal girder into the first portal frame which overhangs the edge of the platform and has its feet joined by a second horizontal girder carrying the bottom housings for the lower turret journals. A control panel for the gangways is situated between the first portal frame and the lower girder forming another

vertical tie in the centre of the structure. The second portal frame is situated on the centre of the lower transverse rail and is tied at the feet by floor support beams. The feet of this portal frame are used to house the traversing wheels, their operating gear and the main anchors for the housing.

Further back the upper side frames are tied on each side; it is open at the back for access to the passengers' customs house. A piece of flooring is provided for matching up with the floor of the turret and extending over the platform rails. Part of this floor is hinged so that it can be lifted clear of the hand rails when traversing the unit along the quay.

Four anchors are provided to hold the unit lower rail consist of "T" headed bolts situated near the traversing wheels and operated by a screw through a handwheel and worm reduction gear.

When the shore housing anchors are freed the electric circuits to the slewing and luffing movements are put out of action and the traversing circuit is brought into operation.

GANGWAY ASSEMBLED AT MAKER'S WORKS

together by another horizontal girder which carries the pivot points for the slewing rams. At the extreme shoreward end the frames are joined by a vertical girder which is connected to the second portal frame by a girder forming a central spine, parallel with the side frames, on which the electrical control gear is mounted.

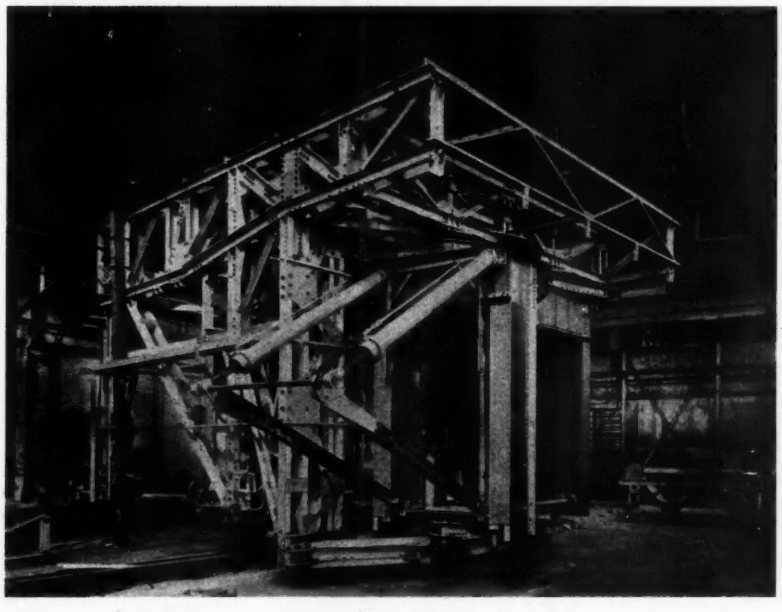
Cross bracing is provided in all bays to control displacements and superimposed on the main framework is a series of sheeting rails, ceiling beams and sliding door support beams.

The ceiling divides the structure into an upper and lower compartment, the upper compartment being used to house a hydraulic pump unit, a cable winding drum, electrical control gear, hydraulic piping and electrical conduits. The outside of the housing is covered with sheet, and is provided with sliding doors

in position against wind loads when it is parked with the gangways lying along the side of the building. Two of the anchors are on the shore housing for coupling to the platform lower rail, and two parking anchors are on the end of the hinged section of the gangways.

Each gangway parking anchor consists of a bracket on the side of the gangway carrying a rod which can be brought out through the handrails so that its end is over the platform rail. When the anchor is in this position a "T" headed bolt can be lowered into a slot in the platform rail and locked in position by means of a handwheel. When an anchor is in this position all the electrical control circuits are broken and no gangway or other movements are possible.

The shore housing anchors on the platform



TURRET ASSEMBLY

The Turrets

Two turrets are carried by each shore housing and each turret provides the journals for pivoting the gangway for the slewing movement and carries the hinge-pin on which the gangway luffs. The hinge-pin to which the gangway is clamped is a 3½in. diameter cross shaft supported in self-aligning roller bearings in the side members of the turret frame. The luffing rams are attached at the upper end of the side members and can clearly be seen in our illustrations. The slewing rams are attached in a horizontal plane on the top of the structure. The turret is suspended on a self-aligning thrust race and the journal loads are taken through self-aligning roller bearings carried on the beams of the shore structure. The turret is finished by sheet fairings to form a cylinder approximately 8ft diameter to cover the luffing rams.

The Gangways

The shoreward section of each gangway, which is hinged to a turret, consists of two deep girder side members, a floor and a roof. Four corner beams of box section form provide a track on which the pads and rollers of the telescopic section ride. Rubbing surfaces for the rollers and pads are provided by "Delaron" laminated plastic strips. The diagonal bracing in the side girders is built up from extruded channel section and plates. The roof is formed by cross-braced curved ribs having longitudinal channel members. To combine lightness with rigidity the floor is built up of corrugated sheeting set between two flat aluminium plates, the upper surface being covered with rubber flooring cemented on and provided with wooden battens at intervals to give a firm foothold at the steepest angle of inclination. Extruded sections, which form the sills for windows, 3ft long and 1ft high, are fixed between the diagonal members in the sides of the gangway.

The outer end of the hinged section carries spring-loaded rollers and pads designed to support the telescoping half of the gangway. During normal working on average extension of the telescoping section the springs hold the rollers so that they carry the weight of the moving section. When this load increases beyond a predetermined limit the springs holding the rollers deflect and steel pads contact the plastic rubbing strips on the boom of the telescoping section to spread the loads over a greater area. The weight of the telescoping section when manœuvring is taken by a single ball race in the upper part of the assembly. Pads which are adjustable for clearance and wear are mounted on the side of the roller support bars to resist the loads imparted by side winds.

The telescoping section of the gangway is similar in construction to the hinged section, but its width and height are such that it fits inside the hinged section. At its innermost end it carries a roller support assembly similar to that of the hinged section. The outer end carries hooks designed for attachment to the shell door threshold of a liner. A flap built from a section of the floor is hinged on the hooks and can be swung on to the ramp in the ship's exit compartment. To cover the space which would be left between the sloping end of the gangway and the side of a vessel a folding weather shield is provided at the extreme end of the telescoping section.

Gangway-Operating Gear

Power for operating each gangway unit is supplied through a trailing cable which can be plugged into the electrical system of the building.

A rotating drum carrying 125ft of cable is situated on the north side of the shore housing in a position where it can be coupled to sockets set 2ft inside the centre of the lower platform

rail. A chain-driven limiting mechanism fitted to stop the traversing motors when the cable is run out is wired up with "North," "South" and "Stop" push-button stations, so that if the cable is run out the unit can be traversed only in the opposite direction.

The traversing motion at a speed of 1 m.p.h. in each direction along the quay is effected by driving two flanged wheels running on the lower platform rail. Each wheel is keyed to a shaft rotating in phosphor bronze bearings and coupled to the output shaft of a 100 : 1 reduction gearbox driven by a vertically mounted 8½ h.p., 1440 r.p.m. motor. The upper pair of traversing wheels which run on the underside of the upper rail are flangeless. They are fitted with phosphor bronze bushes and rotate on steel spindles fixed to the side members of the shore housing structure, as described above.

Slewing of a turret and its gangway is effected by means of a pair of hydraulic rams, placed horizontally in the roof chamber of the shore housing. The gangways can be slewed through about 95 deg. out from the quay, and the time taken for a complete slewing motion is 57 sec. The slewing rams are double-acting, one pushing whilst the other is pulling. The ram pistons are 6½in diameter and have a stroke of 5ft 6in.

Limit switches are arranged to cut out the hydraulic power when the gangways are slewed to the parked position; and a klaxon sounds when the limit of outward slewing is being approached.

The gangways can be luffed or moved in a vertical plane from about 20 deg. below to 20 deg. above horizontal. This movement is imparted by the two rams already mentioned in our notes on the turret construction. These rams, with pistons 5½in diameter by 5ft 10in stroke, are mounted one on each side of the gangway, the cylinder end being pivotally connected to the upper turret frame and the piston-rod end fixed to a beam under the lower beams of the gangway about 12ft from the hinge. Downward luffing movement is by gravity and is stopped when the gangway is horizontal by a stop mechanism which becomes operative when the gangway is between its parking position and slewed out towards the ship approximately 20 deg. The mechanism allows the gangway to luff below horizontal, but only within a limited slewing range.

Telescoping or extension and retraction of the gangways can be effected between the limits of 45ft and 68ft from the centres of the turrets, which are 7ft out from the platform rail. This movement is carried out at a maximum speed of 6·65ft per second. The sliding outer section of gangway is extended and retracted by means of a pair of endless chains mounted on sprockets at each side of the hinged section of the gangway. The chain is of 1½in pitch and is supported and covered by a guard over its whole length. The sprockets on the shore end are driven by similar chains connected to sprockets on the ends of the output shafts of a reduction gearbox mounted underneath the floor of the gangway and driven by a 4 h.p., 1420 r.p.m. motor. A "grab," connecting the telescoping gangway to the chain, is carried at each side of the inner end of the telescoping section. This grab is a short length of rack meshing with the chain. A release mechanism which ensures that the ship does not pull the gangway against the resistance of the telescoping gear, consists of a system of mechanically operated levers actuated from the yoke, which carries a hook picking up the threshold of the shell door of the vessel. As the hook is lowered on to the threshold the yoke is forced upwards into contact with the front cross member of the end frame; thereafter any movement, by actuating a pull rod, lifts the chain grabs out of mesh with the chains.

The grabs are spring-loaded so that whenever the hook is free of the threshold the grab engages with the chain and holds the telescoping gangway. A compensating device is fitted so that in the event of one chain being slacker than the other, the gangway will not move until the load is equalised on both chains. This equalising movement is effected by a Lockheed hydraulic compensating mechanism. The mechanism allows the grab block to float between plungers which form the pistons of a pair of small hydraulic cylinders. If one chain pulls before the other the grab on that side displaces fluid to a supply tank via the cylinder on the opposite side until the port in that cylinder is shut off by movement of its piston. The chains will then be in hydraulic balance and the gangway will move. On release from the chains the grab block is centred by light balance-springs in the cylinders. The hydraulic compensating circuit is self-contained, and the cylinders are self-filling from the supply tank.

The amounts of extension and retraction are governed by limit switches which cut out the telescoping motor. Two warnings are operated by other limit switches; in the first, a bell rings when the gangway is 2ft short of maximum extension, and in the second a danger klaxon sounds when the gangway is 1ft short of maximum extension.

Hydraulic Gear

Hydraulic power for the slewing and luffing movements of the gangway is supplied by a Vickers pumping set driven by a 12 h.p., 960 r.p.m. electric motor. This pumping set, which delivers 13·8 gallons of oil per minute at 1000 lb per square inch, is housed on the roof chamber of the shore structure. It draws oil from the supply tank and delivers it via a relief valve to a ¾in change-over valve on the control panel. The function of the change-over valve is to select either the north or south gangway for manœuvring. The oil passes from the change-over valve to one of two pairs of ¾in control valves. Each pair of control valves is mounted on a bracket with a double gate and single control lever. Upward or downward luffing of a gangway is obtained by forward or backward movement of the control lever at the luffing end of the gate and similar movements of the lever in the slewing position give outward slewing and slewing back to parking position. The control lever must be held during the movement as it is spring-loaded to return to a neutral position at which the gangways are locked. Slewing is locked when luffing is operated and vice versa.

From the control valves the pressure oil passes to release valves and on to the rams. The release valves are solenoid operated and connect with the various limit switches. The valves are spring-loaded into the release position and pulled by solenoids into the working position, so that whenever the circuit to the solenoid is broken by the limit switches, pressure is released in the hydraulic circuit, ensuring that the gangway is able to follow the movement of the vessel without resistance in the rams. A ¾in valve gives full flow to the hydraulic fluid in the direction for upward luffing, but restricts the flow by means of an orifice for downward luffing.

The solenoid-operated release valves are provided with hand-release gear and hand-setting gear for emergency use, and are controlled by the operator from the control panel. The position of the hand-release knob indicates whether the solenoid is in the release of pressure position, and should the plunger stick in the pressure position when the solenoid circuit is broken, it can be released by a pull on the appropriate knob. This hand-setting gear is installed for use when electrical failure interferes with the operation of the solenoid. The plunger of the release valve can be set in the pressure position and held there by pulling the setting knob and turning it through 90 deg.

The control panel is situated in the shore housing between the doorways leading to the turrets and the gangways.

It consists of a front panel with two wings, which is held on a vertical frame. This frame carries the hydraulic control valves, the solenoid-operated valves, limit switches, bells and klaxon, and slew lock solenoids, and is used to support the electrical conduits and hydraulic pipes. The panel carries the selector valve, the pressure gauge, the stop and start push buttons for the hydraulic pump, the telescoping push button controls for both gangways, and lighting switches. The lower half of the front panel is fixed with quickly detachable fasteners and provides access to the back of the panel and into the gangways when they are in the parked position.

A sight hole in the control panel enables the operator to position the gangway correctly before making connection with the ship. Indicators visible at the control station show the amount of slewing or luffing of the gangway, and by looking up the inside of the gangway the operator can make the final adjustments necessary to guide the end to rest on the threshold of the ship's door.

Controllable-Pitch Marine Propeller

Of considerable interest to shipowners and shipbuilders is the Stone-Kamewa propeller fitted to the motor collier "Wandsworth," which has recently entered the service of the South-Eastern Gas Board. The vessel was built by the Burntisland Shipbuilding Company, Ltd., and has a length between perpendiculars of 265ft 10in, a breadth of 39ft 6in, a depth of 18ft 6in and carries a deadweight of 2825 tons. The propelling machinery is an eight-cylinder British Polar reversible oil engine, developing 1180 b.h.p. at 225 r.p.m. and driving a three-bladed Stone-Kamewa propeller of 9ft 4in diameter with a developed surface area of 29 square feet and having the boss and blades of bronze. The propeller was manufactured at the Deptford works of J. Stone and Co., Ltd., the sole licencees in Great Britain and the Commonwealth (excluding Canada) of Karlstads Mekaniska Werkstad.

Although over a hundred propellers of this design have been fitted since 1937 to ships having engines of powers varying from 100 h.p. to 7000 h.p., the "Wandsworth" is the first British ship to be equipped with a Stone-Kamewa propeller. At the invitation of J. Stone and Co., Ltd., we recently were able to make a short voyage on the vessel from Limehouse to Wandsworth and had the opportunity of watching the vessel being manœuvred and of inspecting the gear in the engine-room. With engine turning over at a constant speed of about 135 r.p.m., the vessel was piloted up river at varying speeds and was finally berthed while under direct control from the bridge.

The adjustment of the pitch of the propeller blades and the engine revolutions is effected by means of an operating lever fitted to a control column mounted on the bridge. Each movement of the lever operates the pitch-changing mechanism through the medium of a pneumatic transmission system so that bridge orders are carried out without delay and without any assistance from the engine-room staff, although local control is fitted in the machinery space in case of breakdown.

Economics and Efficiency

The controllable pitch propeller offers many advantages, the most obvious being greater manœuvrability. This is especially helpful when navigating in constricted and crowded waterways, where the instantaneous response to direct control from the bridge is invaluable, eliminating, as it does, any chance of incorrect orders being received or given. Another noteworthy effect is that the blades can be moved quickly to the astern position; therefore the ship can be stopped in perhaps one-third of the normal time because the usual delay in having to stop the engine before going astern is avoided. A point worth noting in the case of diesel machinery concerns the effect of a rapid succession of orders from the bridge which may so reduce the amount of starting air available that there is delay in carrying out a manœuvre.

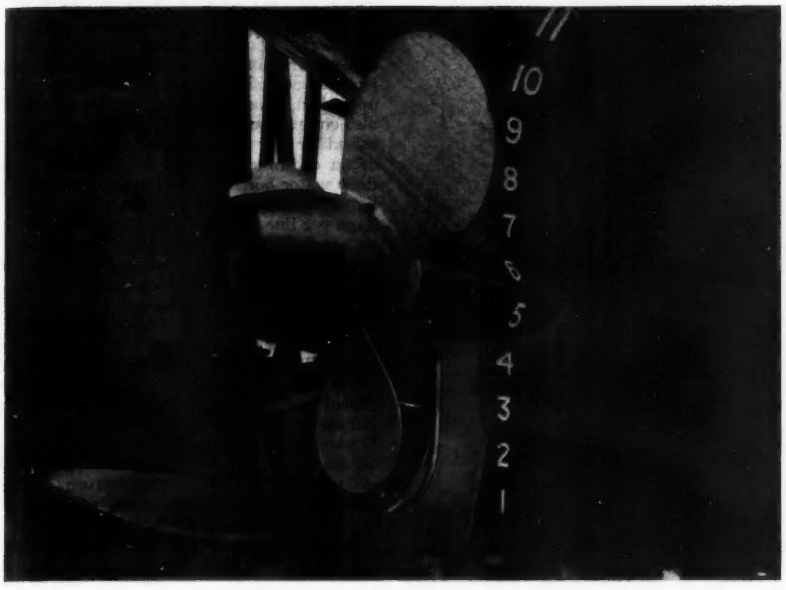
As a corollary to this it can be stated that because the Kamewa propeller makes less demand upon starting air capacity then the air reservoirs could be reduced in size, depending upon official approval.

The controllable-pitch propeller is useful for ships engaged in towing operations, such as tugs, trawlers, whale catchers and minesweepers, and also for icebreakers and submarines which operate under conditions giving rise to varying resistance. Adjustment of the blades enables the propeller to meet the requirements of heavy and light towing and free running and to take up gradually the load in tow rope or trawl so that shock does not occur.

With the torque of an engine constant the output varies with the revolutions. The pitch of the propeller can be adjusted to suit varying conditions of weather, loading and hull under-water surfaces, and depth of water, so as to allow the full output of the engine to be utilised. In practically every ship there are one or two points in the engine speed which fall within the critical vibration range, and these points may be in such close proximity that it is impossible to run the engine within a prescribed number of revolutions per minute. This means that with a fixed-bladed propeller a corresponding range of ship speeds cannot be attained. But with a controllable-pitch propeller the ship could be driven at all speeds by selecting a coarse pitch for the lower speed range and a fine pitch in conjunction with the upper range of revolutions per minute.

The infinite variation in the pitch of the propeller from ahead to astern does mean a great reduction in the number of starts which is reflected in less risk of cylinders cracking, reduction in liner wear, easier maintenance and less fatigue for the engine-room staff. To illustrate this, the figures quoted for the "Snecia" and a sister ship are of interest. During the course of twelve voyages to South America the engines of the "Snecia," which is equipped with two 3500 h.p. Kamewa propellers, were started 102 times, while the number of starts for the sister vessel having a fixed-bladed propeller was 2500 over the same period and in the same service.

Used in association with a controllable-pitch propeller, the engine does not require to be reversible, but the reduction in price due to the omission of the gear is of relatively small amount, so that the reversing gear continues to be retained by most owners as a measure of safety. The steam turbine has astern turbines incorporated in the design; with a Kamewa propeller fitted they would not be necessary, resulting in a small saving in steam consumption. Regarding the gas turbine, one of the difficulties is the method to be employed for astern running. Two fluid couplings on the output shaft is one method which has been adopted, but the controllable-pitch propeller offers another solution to the problem. Additionally the pitch at low speed can be adjusted to enable the turbines to be run at a speed giving maximum efficiency and some economic advantage.

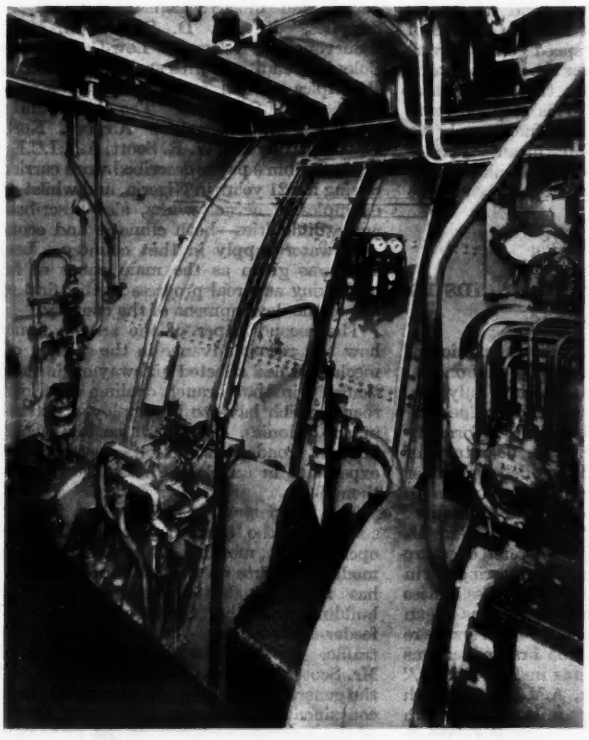


STONE-KAMEWA PROPELLER

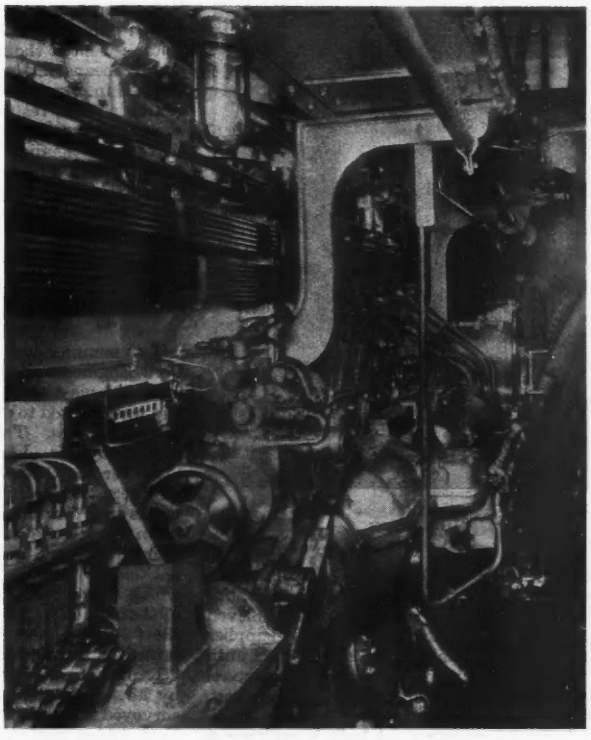
Construction and Component Parts

Much of the basic design of the Kamewa propeller is based on early work connected with "Kaplan" water turbines. The decision was made, at an early stage, to avoid putting additional load on the shaft flanges and thrust bearings by operating the blades by means of a rotating oil pressure cylinder within the hub itself and so constraining the large operating forces within the hubs. By making the hub oil and watertight it can be filled with oil to keep the gear lubricated and friction to a minimum. The blades are arranged to allow the blade, sealing ring, bearing ring, crank pin and sliding shoe to be dismantled without disturbing the rest of the hub. The servo-motor is in the hub and the large blade flange results in the blade root thickness being no greater than that of a solid propeller.

Six bolts fasten the blades to a crank pin ring, which is supported partly on a centre pivot taking the forces at right angles to the pivot, and partly on an outer bearing taking

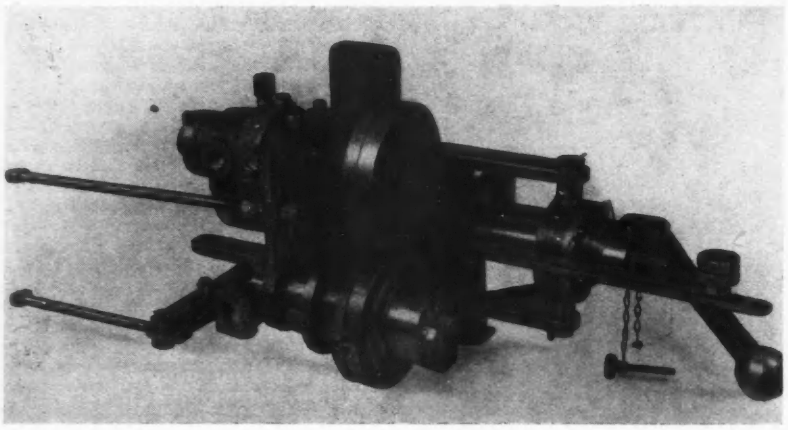


OIL DISTRIBUTION BOX AND SERVO-MOTOR



ENGINE GOVERNOR AND SERVO-MOTOR

blade tilting movement forces. The bonded rubber double-acting hub sealing ring has been tested to 200 lb per square inch and is designed to give increased sealing effect with greater inside or outside pressure. The crank pin itself fits into a sliding shoe running in a groove in the piston-rod head. Axial displacement of the piston carries the sliding shoe along



AUXILIARY SERVO-MOTOR

with the crank pin to turn the blade. The piston operating oil is fed under pressure through a hollow rod in the shaft bore to a regulating slide controlling the flow to one side or the other of the piston. Should the oil pressure fail, the blades might take up the zero or running astern position so that the ship could not be manœuvred. To guard against this, return springs on one side of the piston automatically adjust the blades for running ahead. The hollow valve rod has flexible joints and will not become jammed should the shaft be bent, so that the blades still can be moved.

The oil pressure box receives the return oil and the valve rod is operated by a small auxiliary servo-motor, which can be telemotor

HUB BODY

controlled. For moderate-size propellers the oil pump is driven from the propeller shaft, but for large propellers two electrically driven I.M.O. pumps are used; one constantly supplies oil under pressure and the other runs free until automatically coupled-in during a manœuvre. Oil for moving the propeller blades into zero position when starting is supplied by a small electrically driven pump. A built-in tank and a gravity tank contain the operating oil. The auxiliary servo-motor mounted on the oil distribution box can be operated by "Teleflex" cable up to a distance of 50ft, or by pneumatic telemotor. This consists of transmitters and receivers, the former located in the control pillars. Each consists of a pressure reducing valve, which adjusts the air pressure between set limits. At 7 lb per square inch the receiver sets the propeller blades to maximum pitch ahead and at 22 lb per square inch to maximum pitch astern, each intermediate pressure being linked with a predetermined pitch. The air for the telemotor system is taken from the diesel engine starting air vessel and the pressure is reduced to 36 lb per square inch. The pressure reduction lowers the dew point temperature so that there is no risk of water separation occurring.

Operational Control

Each position of the lever on the starboard side of the control column corresponds to a definite pitch; when upright the blades are at zero, forward movement adjusts the blades for running ahead and movement aft gives astern pitch. The sequence of starting operations is as follows:—Start electrically driven oil pump and check control lever movements, set propeller blades to zero pitch, start main engine, stop electrically driven pump and use shaft-driven pump. On the port side of the control column is sited the engine speed control lever, and by means of a lower lever the engine can be stopped in case of emergency, there being safeguards against restarting. This stop prevents overloading and restricts the fuel supply to that corresponding to full mean cylinder pressure and a red lamp on the pillar warns when the engine pressure rises above the maximum permissible.

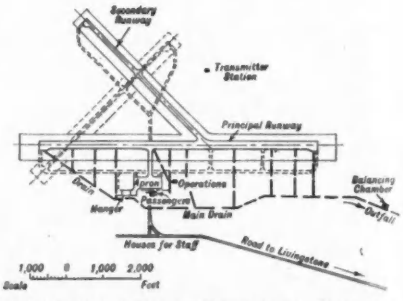
Civil Engineering Problems in the Colonies

The summer conference of the Institution of Civil Engineers was this year held in London, from Tuesday, July 4th, to Friday, July 7th, and was devoted to problems of civil engineering in the colonies. The conference was formally opened by Mr. James Griffiths, Secretary of State for the Colonies, and included a number of interesting technical sessions and visits to works and research laboratories near London.

On Monday evening, Professor Gordon M. Fair, of Harvard University, delivered a lecture entitled "Public Health Engineering," in which he reviewed the scope and possibilities of that subject. The conference sessions began the following morning, when two papers were presented for discussion. The first paper was "Railway and Port Problems in East Africa," by Mr. J. R. Farquharson, A.M.I.C.E., which surveyed the growth of the railway system in East Africa, and commented upon the lines at present under construction and the difficulties and special problems of development in that area.

Mention was also made of the port facilities in East Africa, thus touching upon a problem dealt with more fully in the second paper, "Notes on Colonial Harbours and Wharves," by Mr. R. D. Gwyther. Mr. Gwyther's paper gave rise to a discussion about various modern trends in the design of harbours. The relative merits of double and single storey transit sheds, the correct widths of aprons and the mechanical handling of cargoes were amongst the subjects discussed, and the relative economy of open and closed construction for wharves was also commented upon. Other points of interest raised by this paper included the consideration of an optimum tonnage of cargo for which a deep water berth became more economical than lighterage, and the estimation of the yearly tonnage per lineal foot which could be expected to be handled over a deep water wharf. Some abstracts from this paper, describing some of the colonial harbours at present under construction, will appear in a future issue.

The way in which research engineers can assist in solving the colonial engineer's problems was indicated at Wednesday's technical session when five directors of D.S.I.R. research stations (Road Research Laboratory, Forest Products Research Laboratory, Hydraulic Research Organisation, Building Research Station and Water Pollution Research Laboratory) each delivered a thirty-minute lecture about the work of their establishments, with particular reference to colonial problems. The final technical session of the conference was on



LIVINGSTONE AIRPORT—NORTHERN RHODESIA

Friday, when three papers were read: "Investigation and Construction of Tropical Water Supplies," by Mr. D. S. Bulbin, M.I.C.E., "Survey and Design of Low-Cost Roads for Colonial Conditions with special reference to the Principles of Soil Mechanics," by Mr. A. S. Mitchell, M.I.C.E., and "The Design and Construction of Livingstone Airport, Northern Rhodesia," by Mr. W. R. Scott, A.M.I.C.E.

Mr. Bulbin's paper described work carried out during his 21 years in Nigeria, and whilst giving examples of actual works, also described the acute difficulties—both climatic and economic—of water supply in that country. Lack of staff was given as the main cause of failure in making any real progress in this first essential to the development of the country.

The second paper of the session remarked how the recent advance in the science of soil mechanics had affected highway engineers, particularly in that branch dealing with low-cost roads, which have to be employed extensively in the colonies. The practice and theory of low-cost road construction, based on recent experience in an East African Territory, was then given.

The Livingstone Airport, which formed the subject of the third paper, will be officially opened next month. It is one of the most modern airports on the African continent, and has necessitated the building of runways, buildings and other facilities for handling both feeder-traffic and large trans-continental traffic. A plan of the airport, reproduced from Mr. Scott's paper is shown above. Apart from the general description of the airport, the paper contained an interesting account of the failure of the bitumen surfacing of the principal runway and of the analysis and recommendations

made by the Road Research Laboratory to cure this defect.

Both the technical sessions and the visits of the conference were well attended, many colonial engineers being present. There was a Government reception at Lancaster House, to which all those attending the conference were invited, and an official reception at the Institution on Friday evening.

British Manufacturers of Petroleum Equipment

THE eighth annual general meeting of the Council of British Manufacturers of Petroleum Equipment was held in June, and after being addressed by the chairman received the reports of the director and the technical adviser. In his statement, the chairman, Mr. E. F. E. Howard, briefly mentioned the 1949–50 report, which indicated the increasing activities of the council, listed future visits, gave an account of the various B.S.I. committees and compared the value of orders placed for material and equipment for the first three months of 1950 with the last two quarters of 1949. Continuing, Mr. Howard referred to the list of items still bought by British oil companies in the dollar area and expressed the hope that this dollar drain would be stopped by suitable action. The volume of business not only showed no signs of diminishing he said, but would increase to meet the requirements of the United States oil companies buying in the sterling area because of recent oil agreements. This new factor emphasised the urgent need to maintain advertised deliveries, and the equally urgent need to rectify known faults, for although British oil companies had been remarkably patient, he warned that American companies would be exceedingly critical of material coming from this country and doubted whether they would have any patience. The issue of three booklets entitled "Hints to Travellers," dealing with North America, the Caribbean and the Middle East were announced, and the chairman called attention to the Third World Petroleum Congress to be held in Holland in May to June, 1951.

The director of the council, Colonel A. S. Osborne was pleased to report that the Ministries of Fuel and Power and Supply were now fully aware of the work of the council and that Americans also knew of the organisation. The Register of Vacant Production Capacity had been of great assistance in directing inquiries he said, and he also referred to the value of the Market Information Service.

In his report, Mr. T. L. Bonstow, the technical adviser, made particular reference to standardisation, and said that although certain practices had been upset, considerable progress had been made and mentioned the adoption of new flanges and bolt threads which were U.S. practice in the petroleum industry. By having executive and council support, members of the Oil Companies Materials Committee were able to save time by drafting skeleton specifications previous to discussion. The severe corrosion of ferrous equipment and the astronomical cost of repairs and maintenance made, he said, the work of the Joint Committee for the Study of Problems of Corrosion of paramount importance and that contact had been made with the joint corrosion committee of the British Iron and Steel Research Association and the Department of Scientific and Industrial Research. Continuing Mr. Bonstow mentioned that some American equipment was idle due to lack of spare parts, and informed members that these parts could be manufactured here under licence. The importance of packaging was stressed, especially with regard to the danger of rejection due to faulty packaging, and the technical adviser went on to announce the offer of the use of a climatic research laboratory, in which equipment could be tested under actual working conditions, and that arrangements were being made for members to take advantage of this opportunity.

The A.C. Argon Arc Process for Welding Aluminium

A RECENT report* gives the results of applying electromagnetic and cathode-ray oscillographic recording techniques to the study of certain electrical parameters in the a.c. Argon arc process for welding aluminium. In this report the nature of the output from a commercial high frequency spark oscillator unit, such as commonly used in practice, is considered in relation to its application to this process.

The output from such a unit is not continuous but consists of "grouped series" of sparks separated by "dead" periods in which sparks are absent. It is shown both experimentally and also from a consideration of the nature of this output that it is a matter of considerable importance to the success of the welding process that these injected spark groups should be correctly phased relative to the main welding current, i.e., that correct phase adjustment should be made between the input supplies to the high frequency spark unit and the welding transformer.

The time durations of the phenomena involved in those investigations were of the order of a microsecond for individual sparks, a millisecond for the interval between individual sparks, 6 milliseconds for the spark groups, and 4 milliseconds for the "dead" period between successive spark groups. From a study of the oscillographic data, together with the corresponding weld test runs, it was found that the optimum relative phasing for successful welding was such that the middle of the spark group occurred just after the welding current reached zero.

Correct phasing eliminated half-cycle rectification when operating on a workpiece of an Al-15 per cent Mg alloy, at an open circuit welding voltage of 60V r.m.s. Change of the relative position results in variation in the time delays to arc re-ignition in half-cycles of reverse polarity (workpiece negative). Such delays had a marked influence on current asymmetry, quite apart from the asymmetry which is normally present in the tungsten-aluminium arc unless special steps are taken for its prevention. In these investigations the reverse polarity current decreased by some 30 per cent per millisecond delay from the instant of current zero to the arc re-ignition.

Effects were also noted consequent on changing the work plate material from an Al-5 per cent Mg alloy to commercially pure aluminium, whilst the surface condition of the former was also found to influence results. The differences in behaviour were reflected in the oscillograms.

Some attention is also given in the report to operational adjustments to the spark injector unit, bearing on its efficiency in promoting satisfactory welding; whilst a simple switching method is described for obtaining optimum phasing of the inputs to the high frequency spark injector unit and the welding transformer, for satisfactory welding.

A POCKET CRANE-SLINGING SAFETY CHART.—We have received from the Leeds and Bradford Boiler Company, Ltd., Stanningley, near Leeds, a handy pocket-size safety chart. This chart is made of a white plastic material, measures about 4in by 3in, and is engraved on one side with a chart relating the thickness, area and weight of steel plates and on the other side with a table giving safe working loads for various sizes of chains used as slings at various angles. One edge is engraved with a scale of inches in sixteenths of an inch, and alongside this scale is another scale representing the weight of steel plate in pounds per square foot, the two scales forming together a nomogram. The chart was devised and introduced by the firm as a safety measure, but as it could not be produced economically in the small quantities required for the firm's use, it is offered for sale at a nominal charge to all engineers who may be interested. The price is 10s. for a packet of ten charts. Many engineers will find this chart of use to their slingers.

* By L. H. Orton, J. C. Needham and J. H. Cole: *Welding Research* (Journal of the British Welding Research Association), June 1950.

The British Shipbuilding Research Association—The First Six Years*

By Sir MAURICE E. DENNY, Bt., K.B.E., S.B.†

ALL technical matters are the concern of the Research Board, and as Chairman of the Board the author has been authorised by the Council of the Association to present this paper. The scope and extent of the programme is an indication of the high value which the shipbuilding, ship-repairing and marine engineering industries of this country attach to research in all matters connected with the design of ships.

Without in any way encroaching upon the activities of the long-established professional and technical institutions, the Association is providing neutral meeting ground through its technical committees at which representatives from the various firms participate freely in discussion of problems of common interest.

This condition has probably resulted from the policy laid down by the Council that the Association shall strive to provide ship and machinery designers with data and information that will enable them continuously to improve their products, and that it shall not be the function of the Association to undertake design and development work.

ORGANISATION

The governing body is the Council which has responsible to it a Research Board. The Board early set up a system of main committees, sub-committees and panels, all concerned with particular sections of the research programme. The members of these technical committees are selected so as to include a wide range of interested parties and cover the member firms on both the design and the production sides, shipowners, Government departments and laboratories, universities and technical colleges and Lloyd's Register of Shipping. Thus the theoretical knowledge and experimental technique of the scientists have been harnessed to the practical experience of the men who design, build and operate ships.

Research contracts have been placed so as to make the maximum use of existing facilities in this country, both of equipment and personnel, within the establishments of member firms, in Government research laboratories, at the universities and technical colleges, and with the classification society and other research associations. The arrangements have the additional advantage of avoiding the necessity of building, staffing and equipping laboratories. In certain cases special plant has been provided for items, e.g., the structures testing machine at Glengarnock and the experimental boiler at the Royal Technical College, Glasgow.

A considerable amount of the work is also carried out by the research staff of the Association, most particularly that entailing work on board ships. This use of the ship as a laboratory is a very important feature of the activities.

Reference must be made to the work of the Intelligence Section, the function of which is to collect from all sources and examine technical information relating to the research programme or likely to be of interest to members.

FIELD OF RESEARCH

The various stages in the formulation and execution of a research by the Association are set out in Table I. From the diagram a definite sequence of events can be discerned from the first statement of a problem, through the assessment of its importance to the survey of existing information and thence to the consideration and execution of a programme of experimental and analytical work. Arising from the issue of reports often fresh problems emerge to recommence the cycle.

The field of research is illustrated in Table II, which shows the range of subjects covered and demonstrates the wisdom of the policy of

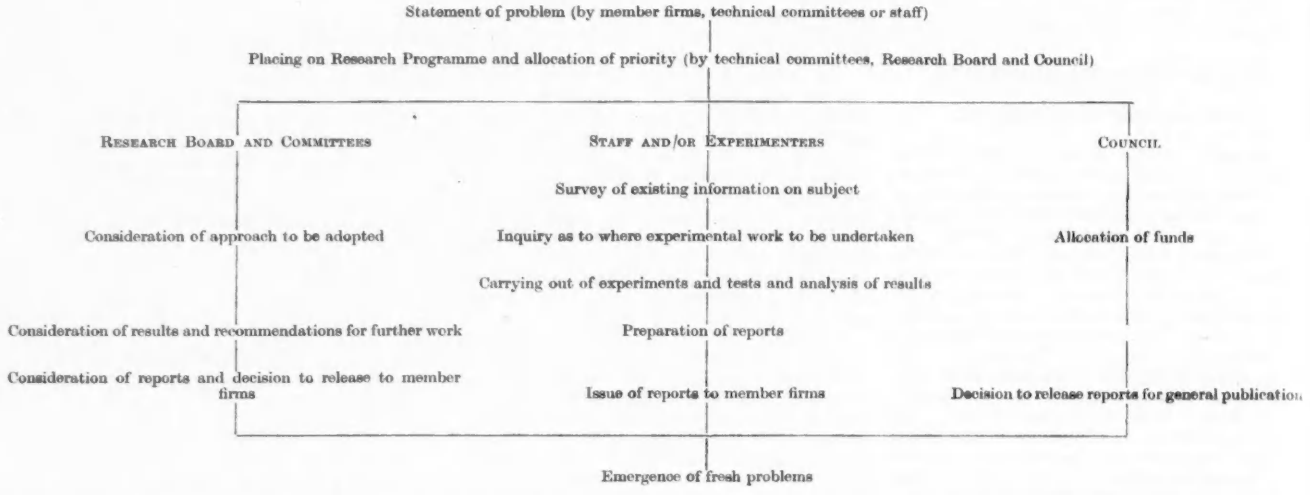
* Institution of Naval Architects, Institution of Engineers and Shipbuilders in Scotland, and North-East Coast Institution of Engineers and Shipbuilders, Joint Summer meeting, Newcastle. June 27th. Abstract.

† Chairman, William Denny and Brothers, Ltd., Member of Council, B.S.R.A.; Chairman of Research Board, B.S.R.A.

carrying out researches extra-murally. By March 31, 1950, forty research reports had been issued to members, including fifteen surveys, so that the position has been reached where a stream of research results is appearing. The majority of the reports are at some stage receiving general publication and many are appearing in the "Transactions" of the various institutions.

The researches disclose certain features common to the whole, and the distinction can be noted between applied and fundamental researches. The former have immediate practical applications, while the fundamental researches are often of a long-term nature. Another common feature is that on many items of work it has been necessary to perfect and improve existing experimental techniques or even to develop new ones. The final important common feature is the number of occasions upon which new problems emerge from the solution of existing ones.

TABLE I—*Formulation and Execution of a Research in B.S.R.A.*


Statement of problem (by member firms, technical committees or staff)
Placing on Research Programme and allocation of priority (by technical committees, Research Board and Council)
Research Board and Committees
Staff and/or Experimenters
Council
Survey of existing information on subject
Consideration of approach to be adopted
Inquiry as to where experimental work to be undertaken
Allocation of funds
Carrying out of experiments and tests and analysis of results
Consideration of results and recommendations for further work
Preparation of reports
Consideration of reports and decision to release to member firms
Issue of reports to member firms
Decision to release reports for general publication
Emergence of fresh problems

Surveys of Existing Information

A survey of existing information, which is the essential preliminary to many researches, has proved particularly necessary in the case of items on the marine engineering section. To provide a summary of information on the fatigue of bolts and studs under combined bending and tension was one of the first tasks of the Association. As a result, a programme has been put in hand involving the testing of specimens over a range of values for the ratio of bolt shank diameter to the diameter over the thread.

A further survey deals with provisions for thermal expansion and estimation of stresses in steam pipe-lines. The more advanced steam conditions in marine practice makes this a subject of importance and the survey was able to include Admiralty experience and practice. Another survey concerns the use of alternating current for ships' auxiliaries, and yet another deals with the use of automatic combustion control for marine boiler installations.

The surveys also include a bibliography on the strength of ships and the application of aluminium alloys to shipbuilding. A similar report was concerned with the descent of smoke and funnel gases on to the decks of ships.

Resistance and Propulsion

When William Froude established the practical utility of scale model experiments, substantial progress began, and from 1867 onwards with the establishment of experimental tanks, the subjects of resistance and propulsion became the active concern of experimenters.

The Association took over and extended a comprehensive programme of methodical model experiments on a series of ocean-going vessels of 400ft. L.B.P. by 55ft beam by 26ft maximum draught and of three separate block coefficients, 0·65, 0·70 and 0·75, including the study of the effect of changes in longitudinal centre of buoyancy position, bilge radius and draught. The effect of fineness is being investigated, by interpolating models of 0·675 and 0·725 block coefficient in the series, and also the effect of beam increases and the addition of a bulbous bow.

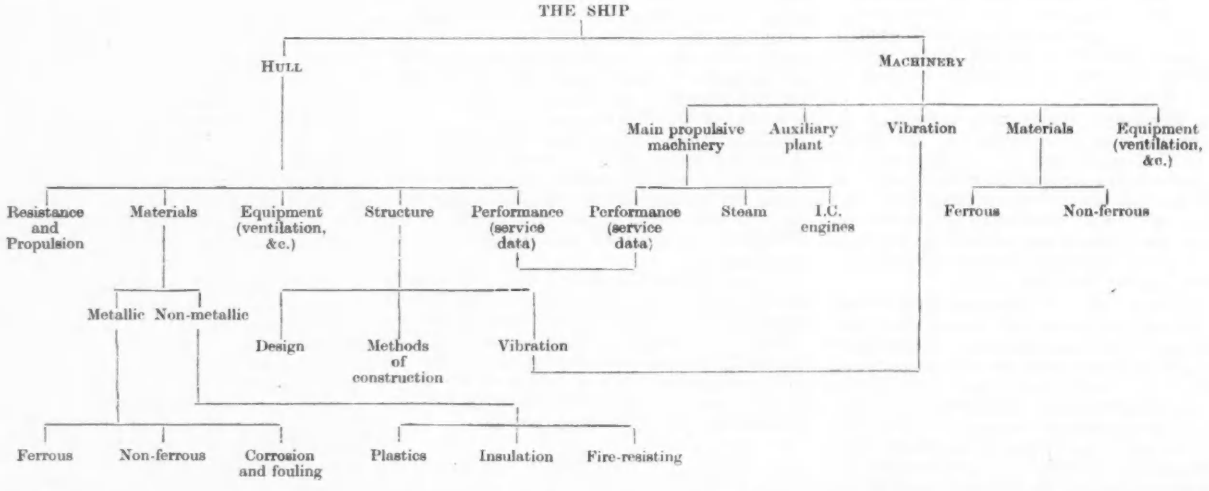
To carry out its heavy programme of tank work the Association required facilities in all the British experimental tanks. A standard model of 0·75 block coefficient was constructed in wood and sent for testing at several draughts to each experimental tank with a view to standardisation of the practices at the various tanks.

From the tests startling results were obtained, and further tests showed that many ship models exhibited laminar flow in the fore-body, so that the coefficients linking tank results to full-size performance would require amendment. The fuller the form the greater is the likelihood of laminar flow occurring, and researches were made to determine the extent of laminar flow in models of different shapes and fullnesses. As a result, all models in British experiment tanks are now tested as a matter of routine with a trip wire of 0·036in (No. 20 S.W.G.) diameter on the surface of the model at a transverse section 5 per cent of the length abaft the forward perpendicular.

Trawler forms are being investigated to determine the effects of increasing midship area and fining the ends. These particular models are being self-propelled in waves so that smooth water results shall be verified in rough water. Some basic design data are also being obtained from model experiments on hopper and dredge forms to determine the effects of raised hopper doors on resistance and the comparative merits of different types of dredge wells.

There are serious practical difficulties in the way of measuring the resistance of a full-size hull, but the Association is attempting to solve this problem, using the hull of the old Clyde paddle steamer "Lucy Ashton." Propulsion will be by jet engines, the thrust of which will be accurately measured. Progressive speed trials at two draughts are to be made and

TABLE II



repeated after a period in which the hull will be allowed to foul. Rudder force and moment tests will be carried out and the effect of dummy bossings and brackets on resistance will be measured. A model of the hull will be made and tank tested in conditions corresponding to those of the full scale. Valuable, perhaps classic, results should accrue from this work.

One of Froude's basic assumptions is that skin friction and wave-making must be treated separately and independently. A panel has been formed to consider this question, and has recommended some experimental investigations. The results obtained may be expected to define the limits within which Froude's assumption is valid.

Structures

The subject of strength of merchant ships has over many years been left almost entirely to the classification societies, and it may be claimed that the structural design of ships has now reached a stage where the stress induced in the main structure when among waves is seldom responsible for damage to the hull structure. Full-scale tests on ships' structures have been made by the Admiralty Ship Welding Committee and have provided much useful information. Electric welding and other new methods of construction are leading to changes in the distribution of structural material.

Structural component tests are being carried out at Glengarnock, where full-scale ship girders, in association with plating, are tested for strength and stiffness under lateral loads. This work was designed to compare the behaviour of riveted and welded construction, but now includes the effects of different types of end connection.

The programme of tests includes the following :—

(i) Flanged stiffeners.
(ii) Castellated welded stiffeners.
(iii) Cantilevers.
(iv) Curved specimens (such as deck beams), curved and shaped specimens (such as side frames).
(v) Hatchway beams and covers, hatch girders, &c.

A machine to test full-size specimens under axial and lateral loads is under construction and it is intended to test :

(i) Stiffened areas of bottom plating.
(ii) Stiffened areas of deck plating.
(iii) Side framing elements.
(iv) Bulkheads acting as beam columns.
(v) Pillars with side loads.
(vi) Effect of curvature on strength of bilge strakes, &c.

Considerable advances have been made in methods for calculating stress distributions in structures, using strain gauge techniques and model experiments check the validity of these methods.

The effect of varying distributions of structural material has been investigated by the bending of a series of parallel thin-flanged box girders, having widely differing distributions of material, with the product E.I. constant. The results were very different from those given by theory, and a working formula has been produced which gives excellent agreement with the experimental results.

A transversely stiffened hull box girder, some 6ft wide by 4ft deep, is being tested in pure bending, to obtain a detailed stress distribution over the cross section before finding the effect of adding deck-houses of various widths to the existing girder.

The bending of model transverse frame rings incorporated into a prismatic girder is to be studied and tested before dealing with the problem of inter-relating transverse and longitudinal strength.

Other items include expansion joints, strength properties of flat plates under both lateral pressures and end loading, and stress concentrations induced at structural discontinuities.

Full-scale tests on strength of ships' structures involving hogging and sagging are difficult to arrange and a possible alternative method is to use a vibration exciter to put the ship into a state of vibration corresponding to the two-node vertical mode. Variations in the amplitude of bending can be obtained, holds can be left empty providing uninterrupted stress surveys over the hull, and deflection curves can be measured by using vibration-recording instruments.

Main Propelling Machinery

Turbines, both steam and gas, are dealt with by PAMETRADA, but reciprocating steam and diesel engines, boilers and engine-room auxiliaries provide plenty of scope for research.

The opinion is held that the future of the two-cycle marine diesel engine is largely dependent upon improvement of the scavenging process, so two single-cylinder opposed-piston experimental engines about 5in bore and 15in stroke for research into this difficult subject are in course of construction.

The research programme deals with the determination of the mechanical efficiency of marine diesel engines. The piston type indicator suffers from many inaccuracies, especially evident when applied to the diesel engine, and an improved technique is being devised for this purpose, use being made of developments in indicating cylinder pressures in the automotive and aircraft industries.

In reciprocating engines, both steam and diesel, uncertainty exists in regard to problems of bearing design. The oscillating bearing has received little attention from experimenters, so that designers have to rely on their own experience when confronted with top end bearing problems. To remedy this situation a special machine has been built and interesting results are being obtained.

The increasing use of advanced conditions of steam pressure and temperature has raised the problem of natural circulation in water-tube boilers. The problem is complicated by the difficulty of achieving similarity in small-scale plant and by deficiencies in measurement technique, so a full-scale, single-tube experimental boiler for an investigation of these problems has been constructed. This plant provides for working pressures up to 1500 lb per square inch, and heat absorption rates up to 200,000 B.Th.U. per square foot per hour.

Materials

The structural material in a ship's hull must not suffer injury from shipyard operations such as punching, shearing, bending, flanging, furnacing and welding, and must bear stresses of all kinds. Failures of mild steel have been few, but there is need to study the mechanism of brittle failure and other troubles.

Apart from price, there are several present-day objections to the use of light alloys, including the lack of information about the behaviour of the materials when subjected to the normal shipyard operations and about the design and construction of riveted joints, and a satisfactory welding technique still awaits development.

Investigations are in hand to determine whether the mechanism of failure of engine parts exposed to combustion conditions is due to fatigue arising from cyclical fluctuations of temperature or to creep. The strength of shrink fits involving tests with full-sized crank web assemblies are in hand, and also tests concerned with the fatigue strength of shafting.

Tests to investigate the relationship between fillet radius and fatigue strength have yielded interesting conclusions.

A survey disclosed a wide divergence in the quality of finish produced in the various shops for engine parts, and also produced the surprising information that a high degree of finish can be obtained by emery polishing or honing after scraping.

The corrosion of tubes in Scotch boilers has caused considerable concern, and it is improbable that the manufacture of wrought iron tubes by the old processes can be recommenced, and means of improving the corrosion-resisting properties of mild steel tubes and the possibilities of a better tube being manufactured in a superior material is being investigated.

Equipment

Heat transfer between sprayed water and steam is a basic process about which little or no fundamental data exist, and designers have been forced to employ empirical methods, so experimental work has been put in hand.

Engine-room ventilation is of increasing importance with the increased power of modern ships. The problems concerned the measuring of conditions as regards warmth ; the maximum conditions of warmth without causing undue discomfort or loss of efficiency by engine-room and boiler-room staff, and a comparison of existing conditions with desirable conditions.

Cargo space ventilation is receiving attention and a study has been made of the moisture characteristics of cargoes and their relationship to efficient sea carriage.

A study is being made of the respective merits of convective and radiant heating of accommodation spaces, and another investigation deals with noise in passenger accommodation of diesel engine vessels.

Vibration

The critical frequencies of a ship hull are not easily determinable in the design stage, when decisions have to be made which cannot later be altered to avoid synchronisation between exciting forces and resonant frequencies, and efforts to improve the methods of calculating ship vibration frequencies for both fundamental and higher modes have been made. A vibration exciter, a machine capable of exerting pulsating forces of various controlled magnitudes and frequencies has been used to stimulate measurable vibration amplitudes. With it mounted at bow or stern, the investigators can determine ranges of vertical and horizontal critical frequencies, knowledge of which is the raw material from which improved methods of calculation can be derived. The vibration characteristics may change appreciably when the depth of water under the keel is less than about five times the draught, and the effect of shallow water is being investigated. The effect of the entrained water which vibrates together with a vibrating ship is considerable and difficult to determine, so model experiments are being made to investigate this entrained water effect for simple prismatic bars of various cross-sectional shapes.

Investigations have been carried out into the flexure of the bed-plate and seatings of a triple-expansion steam engine as part of a general investigation of strength and stiffness of engine seatings with reference to misalignment and crankshaft failures. The main conclusion reached was that the bed-plate and its seatings behaved as a structural entity and that the vertical deflection of the bed-plate was approximately twice that calculated for the flexure of the ship girder over the same length.

Performance

A standard code of trial procedure has been developed for measured mile trials and has been widely adopted.

The corelation of predictions based on model tests with actual results on measured mile trials and throughout the life of a vessel in service is one of the most important features of the Association's work.

In order to collect service data thrust and torque-measuring apparatus should be maintained on a ship for the first year or two to study the power margins required to maintain sea speeds. Radar apparatus for the measurement of speed has undergone tests and offers an alternative method of carrying out trials.

Conclusions

There are items of work which can better be handled by other organisations than by B.S.R.A., and liaison is maintained with the British Welding Research Association, the British Cast Iron Research Association, the British Iron and Steel Research Association, and the British Refractories Research Association.

In the six years that the Association has been in existence, the shipbuilding and marine engineering industry have been fully employed and advantage has been taken of this condition to establish B.S.R.A. as an essential part of the organisation of the industry. Supported by the Department of Scientific and Industrial Research, the Association should prove of immense benefit in helping the industry to maintain the foremost place in scientific shipbuilding.

THE ENGINEER

JULY 14, 1950

VOL. CXC No. 4929

Contents

THE ENGINEER, July 14, 1950 PAGE

LEADING ARTICLES—
FOURTH WORLD POWER CONFERENCE 40
TRAINING OF SUPERVISORS 40

SPECIAL ARTICLES—
INSTITUTION OF NAVAL ARCHITECTS: JOINT SUMMER MEETING IN NEWCASTLE. No. II 31
NORTH OF SCOTLAND HYDRO-ELECTRIC SCHEMES: AN INTRODUCTORY SURVEY. (Illus.) 28
ROYAL SHOW AT OXFORD. No. II. (Illus.) 42

A.C. ARGON ARC PROCESS FOR WELDING ALUMINIUM 37
BRITISH MANUFACTURERS OF PETROLEUM EQUIPMENT 37
BRITISH SHIPBUILDING RESEARCH ASSOCIATION—
THE FIRST SIX YEARS 37
CIVIL ENGINEERING PROBLEMS IN THE COLONIES. (Illus.) 36
CONTROLLABLE-PITCH MARINE PROPELLER. (Illus.) 34
ELECTRIC COMPUTER 47
FOURTH WORLD POWER CONFERENCE 46
HAND-HYDRAULIC ENGINE STARTER. (Illus.)... ... 45
TELESCOPIC GANGWAYS FOR NEW OCEAN TERMINAL, SOUTHAMPTON. (Illus.) 32

LETTERS TO THE EDITOR—
THE STANDARDISATION OF ENGINEERING PUBLICATIONS 41

LITERATURE—
BOOKS RECEIVED 41
SHORT NOTICES 41

A SEVEN-DAY JOURNAL 27
AGRICULTURAL ENGINEERING COURSE
BRITISH CAST IRON RESEARCH ASSOCIATION
BRITISH NON-FERROUS METALS FEDERATION
CHAMBER OF SHIPPING
ELECTRICITY LOAD SPREADING
EXHIBITION OF INDUSTRIAL POWER
PLANNING AND THE IRON AND STEEL INDUSTRY

NEWS AND NOTES—
AMERICAN ENGINEERING NEWS. (Illus.)... 48
BRITISH PATENT SPECIFICATIONS. (Illus.) 51
BRITISH STANDARDS INSTITUTION 45
CATALOGUES 52
CONTRACTS 52
FORTHCOMING ENGAGEMENTS 52
FRENCH ENGINEERING NEWS 50
INDUSTRIAL AND LABOUR NOTES 49
NOTES AND MEMORANDA 50
PERSONAL AND BUSINESS 52
REPORTS ON GERMAN AND JAPANESE INDUSTRY ... 52
TECHNICAL REPORTS 44

NOTICE TO READERS

All letters intended for insertion in THE ENGINEER *or containing questions should be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

No undertaking can be given to return drawings or manuscripts; correspondents are therefore requested to keep copies.

For Subscription Rates, see page 2 of Advertisements.

As a consequence of the continued ban on overtime working by the London Society of Compositors—originally notified in our issue of June 2nd—we regret that the size of "The Engineer" still remains restricted. We regret also that there seems to be no early prospect of a return to a normal number of editorial pages.

FOURTH WORLD POWER CONFERENCE

LAST Monday there opened in London the Fourth World Power Conference. On another page of this issue we start printing abstracts of some of the "General Report" papers that summarise the very numerous papers presented to each section of the conference. The theme of the conference is "World Energy Resources and the Production of Power," and nearly 1600 delegates and members are attending it from 47 different countries. As usual the official languages of the conference have been English and French and the proceedings are being simultaneously interpreted from and into both languages.

The World Power Conference came into being in 1924, and it is very nearly true to state that it was the creation of a single man. During the first World War the late Mr. D. N. Dunlop was greatly impressed by seeing what scientists and engineers of several nations working together could achieve. Thus, when with the support and financial backing of the Council of the BEAMA, a conference, similar to those held later, was arranged in 1924 at Wembley, Dunlop considered it the first of a series of such conferences. The conference agreed with him. For there and then all the countries united to urge the setting up of a permanent international organisation. Dunlop became the chairman of the International Executive and of the British National Committee. It is largely a consequence of his enthusiasm and wisdom that the new international body achieved such permanence as to survive the disturbed years before the second World War and that cataclysm itself. For the constitution that was drawn up showed such foresight and common-sense that no major alteration has proved necessary in the last twenty-five years, disturbed though they have been by international rivalries. From the beginning, Dunlop insisted that the Wembley meeting should be accepted as the "First World Power Conference." The second plenary meeting was held in Berlin in 1930, and third in Washington in 1936. The fourth, according to the plan that such meetings should be held every sixth year, should have been held in 1942. But the war, naturally, caused its postponement. Thus it is now fourteen years since the last full-scale conference was held. However, at intervals ever since it was set up the conference has held sectional meetings for the discussion of particular fields of world power development. One such sectional meeting has already been held since the war, at the Hague in 1947, when the subject was, very appropriately in the circumstances ruling at the time, "Fuel Economy." Moreover, the conference has a "daughter" organisation, the "International Congress on Large Dams," which was created in 1929. That organisation, too, has had a post-war meeting. It was held in Sweden in 1948.

At the opening of the conference last Monday, Sir Harold Hartley, the chairman, read a message from Princess Elizabeth, who is patron of the conference. It contained the passage "I have read with deep interest of the work of the conference, and it seems to me to hold the key to many of the problems which the world is facing to-day. Energy is needed to repair the damage which its misuse by man has caused and the proper use of energy will help to raise the standard of living all over the world." That passage points out what Mr. Kenneth Younger, Minister of State, emphasised in welcoming the delegates on behalf of the Government. To engineers the improvement of technology is a desirable end in itself. But laymen see it in a different light. To them it is a means of providing higher and higher standards of life. It is for that reason and because changing social standards and varying social standards in different parts of the world create social strains that, as Mr. Younger pointed out, politics and engineering developments impinge upon each other. Yet in the discussions that have taken place at the conference this week, politics, fortunately, have played a very minor part. In the World Power Conference, whatever may happen at more political international gatherings, engineers can come together in the amity bred by an intense mutual interest, transcending all national boundaries, in the advancement of their art and science. It may be that engineers ought to take a greater interest in the political implications of their work. It is a point often maintained. But, in fact, they are more happily employed in developing the means of improving standards of living than in attempting to solve the social problems they thus create. Certainly, at the World Power Conference, discussions of political implications would be out of place, important though they are. For the object of the conference is the dissemination of knowledge of power technology over the earth in the belief that thereby the rate of technical advancement can be accelerated. It is for other bodies to solve any social problems that may thus be created.

TRAINING OF SUPERVISORS

THE lot of the foreman is in many ways an unenviable one in that while he is expected to have his interests on the side of the management, too often, without the authority and status that such a position undoubtedly warrants, he is also supposed at the same time to retain the sympathy and understanding of the workmen under him. He is like the unfortunate mariner of bygone days, compelled to navigate his fragile craft in the narrow waters without being shattered on the rocks of Scylla or coming to grief in the equally dangerous whirlpool of Charybdis. It is easy enough to lay down as a maxim *medio tutissimus ibis*, it is not so simple to find that middle course which will satisfy both parties. In days that are past the best craftsman was normally promoted to the position of chargehand or foreman, without consideration being given as to whether he had the other attributes necessary for the post. Then at a later date more care was taken to ascertain his abilities and general qualifications before a selection was made. Nowadays, however, it is being increasingly recognised that a good deal more is required, and that hardly anyone can fill the bill without some degree of training, calculated to make the new supervisor realise his responsibilities and the potentialities of the post he is about to be called on to assume. Many expedients have been tried by different firms, such as arranging for a foreman to visit outside factories, to be moved to the various branches of his own firm, and to attend a series of lectures which have been so arranged as to give him an insight into the general layout of the organisation and to explain how his own job fits into the scheme of things. While much might be said for all this, there is one serious handicap, in that most foreman have a rooted objection to being asked to "go back to school," as they regard these lectures, especially if they are expected to answer questions afterwards.

In a brochure that lies before us, entitled "Handbook for Supervisors," Tube Investments, Ltd., has attempted to solve the problem in an original way, by clearly setting-out in a well-defined form all the general information which both foremen and chargehands require in the effective carrying out of their jobs. The supervisor is first reminded that to be a success in his work, not only is technical ability a necessity, but initiative, good judgment and human understanding are essential. The first thing for him to grasp is a clear appreciation of the nature of his duties, too often

not even mentioned, with the result that he does not realise that, in addition to his being responsible for the efficiency of the production as regards quantity, quality and economy, he is also answerable for the smooth running of his department, for maintaining good industrial relations, and ensuring a high level of morale among his workmen, while if good discipline is to be found in a manner that will obviate friction, he must see to it that good working conditions are provided for his men, and always have a tidy shop, indeed one of which he can reasonably be proud. If a foreman is to carry out his duties effectively, certain qualities are essential, and perhaps the most important of all is leadership, for it is perfectly true that if a man cannot lead others he may just as well give up the idea of being in charge. It is, today, however, considered that this is a quality that can be developed by patient practice. Often a supervisor is so keen that he tries to undertake too much himself, whereas the really successful one knows how to delegate responsibility and so have more time to devote to the things that really matter. Then, again, a supervisor must know how to manage men, not by giving arbitrary commands, not by bullying nor by favouritism, but by being human in outlook, able to put himself in the other man's place, and to foster a spirit of comradeship. If he realises from the start that men and women are not machines, but that each is different from the other and that each deserves individual treatment he will be well on the way to gaining the confidence of his team. A man who "blows hot and cold," is easy going one day and strict the next, must engender a spirit of distrust. Too often none of us realises fully that those who make anything worth making will on occasion make a mistake, while often the very mistake is an education in itself. Frequently by carefully explaining to an intelligent worker the broad policy of the company much trouble is subsequently saved. A foreman, indeed everyone in a position of responsibility, should always remember that his training is never complete, and this ought to encourage him to do all in his power to help the apprentices entrusted to his care, and in training them to see that they always have sufficient to do, and that they are not kept unduly on work that is purely routine.

It may, perhaps, be argued that by telling a supervisor that he should listen, think and act, be systematic, adaptable, honest, be human, be natural, be fair, be a good listener, be patient and possess all the other fine qualities on which we have already touched, a spirit of despair might be engendered and with it a temptation to "throw up the sponge." For none but the hero of a popular novel could mix all those qualities. But we cannot help feeling that by setting a high ideal and putting it clearly in black and white in the hands of each man appointed to a supervisory position, or indeed also in the hands of those who have legitimate aspirations to go higher on the industrial ladder, much good may be done not only in setting a high standard, but also in producing a spirit of self-examination, so that eventually in a sense the supervisor will be unconsciously his own instructor. The idea of a handbook of such a nature commends itself and no harm can ever be done by "hitching one's wagon to a star."

Letters to the Editor

(We do not hold ourselves responsible for the opinions of our correspondents)

THE STANDARDISATION OF ENGINEERING PUBLICATIONS

SIR,—The co-ordination of all branches of British engineering is more than usually desirable in these days of economic difficulty, and much could be achieved by standardising the preparation, distribution and tabulation of catalogues, technical publications and periodicals. Much time is wasted in design offices and purchasing departments in delving into the hotch-potch of catalogues, brochures, pamphlets and loose sheets of varying sizes and types, devised and circulated by individual firms.

A standard printed post card might be devised for advising clients of the publication of a new catalogue, for applying for a copy and acknowledging receipt of same. Again, it seems reasonable to suggest that a uniform size might be adopted for easy storage in the technical library, and a standardised steel cupboard for their reception. A colour scheme for book covers would differentiate between the main branches of the industry, and even sub-divide their suitable sections. Certain salient facts might always be printed on the face cover or fly-leaf. At times one searches in vain for a firm's name, trade mark, address, telephone number and telegraphic address. The date of issue is invaluable when catalogues are stored and used for years, and often one must browse through the whole book to discover the range of goods available. The numbering of pages and style or position of indices might also be regularised without destroying the individuality of the book. The circulation of paper-covered pamphlets seems less desirable than that of stiff covered books, on the score of durability and ease of storage. The design office would like the fullest possible technical information regarding the contents of a catalogue, and the purchasing department requires a basic price list, which could be adjusted from time to time. A pocket inside the back cover would be useful for additional information, again printed on a standard sized sheet.

Some of the suggestions already made might also be applied to technical books and periodicals. One finds THE ENGINEER itself of a most awkward size to read in a bus.

Finally, it might help considerably if every public reference library in the country had a complete register of every form of technical literature published in Great Britain and overseas. If one requires, say, a vacuum pump, the list would record the name of every manufacturer, and references to any relevant source of information on the subject.

ERNEST WOOTTON

Chingford, E.4, July 1st.

Literature

SHORT NOTICES

Electrical Measurements and the Calculation of the Errors Involved (Part I). By D. Karo, A.M.I.E.E. London: Macdonald and Co. (Publishers), Ltd., 19, Ludgate Hill, E.C.4. Price 18s.—This book makes an unusual but logical approach to the subject of electrical measurements, by examining the errors involved in all the well-known methods of measurement. From this approach the author proceeds to study the limitations of various instruments and to indicate the conditions for which each is suitable. This volume (Part I) deals only with d.c. measurements and instruments, as mentioned on the jacket; unfortunately, this limitation is not expressed in the title of the book, which therefore might give the impression that the whole field of electrical measurements is covered in the one volume.

In the first and second chapters the author describes and classifies errors in measurement and indicates how these errors can be calculated. He then gives a systematic treatment of the measurement of medium, small and high d.c. resistances, the calibration and testing of d.c. instruments and the measurement of current, potential difference and e.m.f. Subsequent chapters are devoted to d.c. galvanometers, the fluxmeter, and permanent magnet moving coil ammeters and voltmeters. To round off the subject there is a short, but adequate, treatment of the measurement of the resistance of batteries, followed by a final chapter on the measurement of insulation resistance of installations.

Electronics: Experimental Techniques. By W. C. Elmore and Matthew Sands. London: McGraw-Hill Publishing Company, Ltd., Aldwych House, W.C.2. Price 32s.—This volume is one of a series which will form a record of the research work on nuclear energy done under the Manhattan Project and the Atomic Energy Commission. When completed, this series is expected to comprise some sixty volumes, divided into eight divisions. The book under review is the first volume of division V (which is concerned with the Los Alamos Project) and it deals with some of the electronic circuits and experimental techniques used at Los Alamos and now considered to be of interest to the outside world. From the many hundreds of circuits that were available a choice was made of those that were judged to be of the greatest potential use in laboratories outside Los Alamos.

The book opens with a brief treatment of the properties of circuit components, followed by a chapter on circuit elements describing, for example, amplifier stages, blocking oscillators and similar elements which are used repeatedly in the completed circuits. The complete circuits selected for description are arranged in five general categories—voltage amplifiers, electronic counters, oscillographs and associated equipment, test and calibration equipment, and power supplies and control circuits.

Soil Mechanics in Road Construction. By C. F. Armstrong, A.M.I.C.E. London: Edward Arnold and Co., 41, Maddox Street, W.1. Price 30s.—A general introduction to the study of soil mechanics is provided by this book, with particular reference to the needs of the road engineer. The general behaviour of soils are discussed in the opening chapter, and a brief history of the development of soil mechanics and the particular problems encountered, and the research work in progress in that subject are given. Soil surveys are next considered, followed by chapters on the classification of soils and the testing of soils. The application of soil mechanics to engineering design is exemplified by chapters on the design of flexible pavements, foundation design, and the treatment of embankments and cuttings. Methods of subsoil drainage are then described, and soil stabilisation processes are dealt with in detail. The last chapter discusses points affecting developments overseas, and there is a glossary of terms and abbreviations and an extensive bibliography. The book is well illustrated and a practical approach to the subject has been adopted throughout.

BOOKS RECEIVED

Definitions and Formulæ for Students: Applied Mechanics. By E. H. Lewitt. Second edition. London: Sir Isaac Pitman and Sons, Ltd., Pitman House, Parker Street, Kingsway, W.C.2. Price 1s.

Principles of Electroplating and Electroforming. By William Blum and George B. Hogaboom. Third edition. London: Mcgraw-Hill Publishing Company, Ltd., Aldwych House, W.C.2. Price 51s.

The Royal Show at Oxford

No. II—(*Continued from page 16, July 7th*)

THE Royal Agricultural Society's annual show, which was held at Kidlington, Oxford, last week, ended on Friday, when it was stated that the attendance during the four days was 122,236, a figure which was 64,442 below the attendance at last year's Show at Shrewsbury. This year's event was staged on a considerably enlarged site—150 acres in all—and at no time did the showground appear uncomfortably crowded. But heavy rain on the day before the opening and also on Thursday last made conditions underfoot very difficult in places, and even the main avenues built up by railway sleepers were by no means easy to walk upon! The President of the Royal Agricultural Society, H.R.H. the Princess Royal, was present throughout the week, and among the ceremonies in which she graciously participated was the award on Thursday last of the Society's gold medal to Sir Roland Burke, who has for many years acted as Honorary Director of the Show. Sir Roland is now retiring from that position and the gold medal acknowledges not only his work for the success of the "Royal," but also his distinguished services to agriculture.

There was no lessening of interest in the variety of machinery, implements and other farm equipment displayed on the 730 trade stands. The visitors throughout the week included many from overseas, and they paid close attention to the products of the British agricultural engineering industry. In the Society's new implement competition there were twenty-one entries finally accepted for judging. The judges were Dr. W. Cornelius Davies, immediate Past-President of the Institution of British Agricultural Engineers; and Mr. W. Newcome Baker, a Norfolk farmer. They made five silver medal awards as follows:—Catchpole Engineering Company, Ltd., sugar beet top saver; Harry Ferguson, Ltd., post hole digger; Ford Motor Company, Ltd., root harvester; Rustproof Metal Window Company, Ltd., manure conveyor; and Templewood Engineering Company, Ltd., Mark I grass drier. An impressive item in the programme on three days of the Show was the parade, in the Main Ring, of twenty-one British-made tractors, several of them with implements attached. This parade was organised for the first time last year at Shrewsbury.

We continue below an illustrated description of some of the machinery and implements which were exhibited.

Brockhouse Engineering (Southport), Ltd.

The B.M.B. Products Division of Brockhouse Engineering (Southport), Ltd., Southport, Lancs, exhibited for the first time a neat four-wheeled tractor which it has recently designed and put into production. It is called the "President"—a name which, the makers observe, is the same in every language—and is illustrated in the engraving Fig. 6. This tractor is powered by a Morris 8/10 h.p. engine, with four cylinders, 57mm bore by 97mm stroke, which can be fitted for use either with petrol or T.V.O. as required. It is stated that the engine is capable of developing 6·75 b.h.p. with 35 lb per foot torque at 1000 r.p.m. and 18·5 b.h.p. with 39 lb per foot torque at 2500 r.p.m. The drive is taken through a single-plate clutch to a gearbox giving three forward speeds ranging from 1·75 to 8 m.p.h., and a reverse speed of 2·8 m.p.h. The wheel base of the "President" is 67½in and its normal track 40in. The tractor's overall length is 8ft 4in, its width 5ft 6in over wheel hubs, the ground clearance being 21in under the centre and 19½in under axle. Its total weight is approximately 1800 lb. A swinging adjustable type drawbar is supplied for haulage use and, for implement attachment, a mid-mounted drawbar or a rear three-link suspension can be provided. The power take-off system, extending rearwards below the differential unit, consists of a 1⅛in standard spline shaft running at 550 r.p.m. with an engine speed of 2100 r.p.m. Provision is also made for hydraulic lifting equipment, which is fitted at the side of the tractor gearbox. A single unit includes the pump and control valves, the reservoir being incorporated in the gearbox. The working pressure is 400 lb per square inch. It may be added that at every stage in the design of this tractor the makers have consulted Swedish and other overseas agricultural machinery experts, with a view to suiting it as far as possible to working conditions abroad as well as in this country.

In addition, Brockhouse Engineering (Southport), Ltd., was also showing the implements which have so far been designed for work with the "President" tractor. They included a digger plough with swivel disc coulter, a spring tine harrow, tandem disc harrows, reversible point and wide hoeing cultivators, and a ridger. In the case of the wide hoeing cultivator and the ridger, track eliminator gear is fitted at the rear of the tractor to eliminate rear wheel marks. The gear operates in uniformity with the mid-mounted tool bar.

Bristol Tractors, Ltd.

Among the crawler tractors exhibited at Oxford last week was a wide-gauge model of the "Bristol 20," which is now being manufactured by Bristol Tractors, Ltd., Earby, via Colne, Lancs. This model, which we illustrate in Fig. 7, has been designed to a track centre width of 44in, compared with the standard 29½in width. The engine is a four-cylinder overhead-valve Austin industrial unit, capable of developing 22 b.h.p. at 1500 r.p.m., and the gearbox provides for three forward and reverse speeds of 1·8, 2·85 and 5·85 m.p.h. In the new model longer track units have been fitted, each with six weight-carrying rollers, which are claimed to give smooth riding under all conditions. The tracks are of rubber-jointed construction, each track frame unit being independently mounted and free to pivot about the transmission. The new tractor, like the firm's standard model, has an overall length of 7ft 11½in, a ground clearance of 14in, and a total weight of about 3000 lb. Its hydraulic power lift is attached to the rear end of the transmission housing and is driven from the layshaft. It consists of a constantly driven four-cylinder pump, lifting cylinder, lifting shaft with lifting levers, control gear, and upper and lower linkage for implement attachment.

W. L. Holland, Ltd.

Manipulating a spade mechanically is the purpose of the Adam's delver, which was entered for the silver medal competition and was exhibited on the stand of W. L. Holland, Ltd., Adelphi Works, Preston, Lancs. It is a tool which has been designed for use in a

Fig. 6—B.M.B. "President" Tractor—Brockhouse

Fig. 7—Crawler Tractor—Bristol

large garden or by nurserymen. There are many professional and amateur horticulturists who would agree that the spade is one of their most important tools, for, by delving, the soil is broken up without panning and, of course, the weed is buried. The Adam's delver sets out to reproduce as nearly as possible the action of a gardener using a spade. The implement, a photograph of which is reproduced in Fig. 8, is powered by a

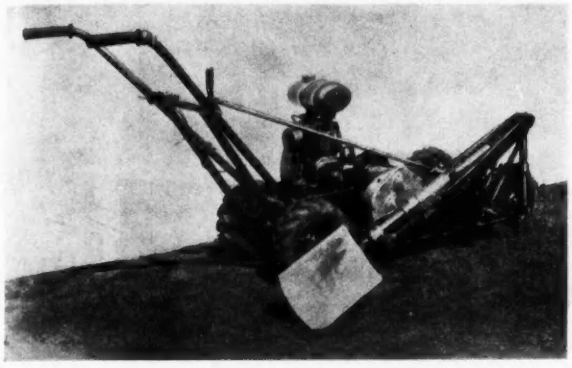


FIG. 8—ADAM'S DELVER—HOLLAND

98 c.c. J.A.P. petrol engine and is carried on four small pneumatic-tyred wheels, with handlebars projecting to the rear. Through a reduction gear the engine drives a transverse shaft carrying a crank pin outside the right-hand frame. By quite a simple system of links and stops the crank pin operates a spade blade by pressing it nearly vertically into the ground, breaking the soil away, lifting it and finally turning it over.

The drawing, Fig. 9, indicates the arrangement of the delver and the manner in which it is manipulated by the link gear. A pair

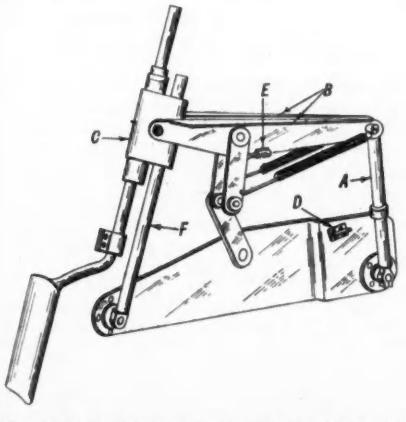


FIG. 9—ARRANGEMENT OF DELVER—HOLLAND

of beams *B* are pivoted at the forward ends to the anchor link *A*, the lower end of which is keyed on a shaft running inside the forward axle. The rear ends of these beams are pivoted to the crosshead *C* in which the spade shaft is free to turn, within limits, and which slides on the guide rod *F*. Tension springs connect the lower ends of a pair of connecting-rods to the anchor link beam pivot. The guide rod is free to swing forward to the horizontal, but is stopped from swinging rearwards at 20 deg. from the vertical. The anchor link is free to swing forward, except for the action of the tension springs, but its rearward swing is limited by the stop *D*. The connecting-rods can swing rearwards on the beams—against the pull of the tension springs—but forward swing with respect to the beams is limited by the stops *E*. In the position shown in the drawing the tension springs are holding the connecting-rods against the beam stops *E*. From this position the crank pin, moving anti-clockwise, takes the beams and cross head rearwards until the guide rod is stopped at 20 deg., when the movement of the crank pin brings them downwards, the beams pivot on the anchor link end and the crosshead moves down the guide rod, forcing the spade into the ground. Near the bottom end of the travel of the crosshead the swing of the anchor link is stopped and the beams, pivoting about the end of it, force the guide rod to swing forward, lifting the spade out of the ground and into a horizontal position, as shown in Fig. 8. At the same time an arm on the spade shaft meets a ramp on the far beam and turns the spade over. When the guide rod is horizontal the crank is on bottom dead centre and the connecting-rods return against the beam stops, so that the connecting-rods, beams, crosshead and spade are lifted up the guide rod to the original position; the swing of the anchor link operates a ratchet gear which traverses the machine forward to the position for the next stroke of the spade. The coulter swings on a bracket on the front axle, into its working position underneath the machine, where it cuts a clean edge for the spade and holds the machine on a straight course against the offset reaction of the spade.

The makers claim, incidentally, that the machine weighs approximately "the same as a man with a spade."

TURNER MANUFACTURING COMPANY, LTD.

In our articles on last year's Royal Show at Shrewsbury we described—THE ENGINEER, July 22, 1949—the 40 h.p. diesel-engined tractor built by the Turner Manufacturing Company, Ltd., Villiers Street, Wolverhampton. The tractor, which is known as the "Yeoman of England," was to be seen on this firm's stand at Oxford last week, and with it there was shown some of the equipment to which it has been found to be well suited. The engraving, Fig. 10, illustrates a "Yeoman" tractor drawing a three-furrow mounted "Scotia" plough made by the Ardrolic Engineering Company, Ltd., Milngavie, Scotland. This company was exhibiting at the Royal Show, its stand including the three-furrow plough illustrated, a four-furrow plough which is also adapted to work with the "Yeoman," and other implements in the "Scotia" range. The three-furrow plough can be supplied with three different types of bodies, which are interchangeable. The furrow width can thus be varied from 10in to 12in as required, an adjustment which can be easily and speedily made. If the front and rear "legs" are bolted inside the frame the plough is set for a 10in width; to adjust to a 12in width these legs are fitted to the outside of the plough beam. The four-furrow mounted plough is a general-purpose implement with a fixed furrow width of 12in and a depth of 7in. Special care has been taken in the design of the mould board, which has an 18in fore-and-aft body clearance. It is fitted with disc coulters which are adjustable in all directions.

Other equipment for the "Yeoman" is being produced by H. Leverton and Co., Ltd., Spalding, Lincs. Among it, there are two-beam and three-beam rear-mounted toolbars for power-lift operation. They are provided with screw-type adjustable depth

FIG. 10—THREE-FURROW MOUNTED PLOUGH —ARDROLIC

wheels. The attachments for these toolbars include rigid cultivating tines fitted with duckfoot or reversible steel points, and spring tines, with the springs set above the toolbar to give a lift of 8in for each tine.

A useful refinement added to the Turner "Yeoman" tractor itself is, we noted at the Show, a light-weight cab to give the driver protection from the weather.

CATCHPOLE ENGINEERING COMPANY, LTD.

A silver medal was awarded by the R.A.S.E. to the Catchpole Engineering Company, Ltd., Stanton, Bury St. Edmunds, Suffolk, for the sugar beet top saver, which, together with the firm's beet harvester and a new pick-up loader, was exhibited. The top

FIG. 11—SUGAR BEET TOP SAVER—CATCHPOLE

saver is the latest addition to the Catchpole beet handling equipment, and underwent some exacting field trials during last winter. It is operated by power take-off from a tractor and the actual topping unit is in many respects the same as that fitted to the

harvester built by this firm. The topper is free to rise and fall in the frame of the machine and positions itself on each beet individually. The actual topper knives are provided with spring action so that they open both vertically and horizontally if stones or other obstructions are encountered. As the tops are cut they are pierced by picker wheels and fed into the side elevator. The engraving, Fig. 11, illustrates the implement. It will be noted that the steering is arranged in a way that gives the operator a clear view of the work.

The Catchpole beet harvester was described in our issue of November 5, 1948, though since then some further development of it has taken place. The two latest types of harvester were shown at Oxford, one equipped with a side elevator and the other the rear elevator and trailer model. Basically, however, these harvesters differ little from that originally designed by the company.

RANSOMES, SIMS AND JEFFERIES, LTD.

Ploughs of many descriptions, tractor cultivators and spraying equipment formed the major portion of the exhibits on one of the two stands occupied by Ransomes, Sims and Jefferies, Ltd., Orwell Works, Ipswich. It is of special interest to recall this year that the firm was the principal implement exhibitor at the first Royal Show at Oxford in 1839. The official report of that Show recorded that "the Society, at the recommendation of the judges, awarded the gold medal to Messrs. Ransome, of Ipswich, who contributed largely to the exhibition, having sent up their wagons laden with more than six tons of machinery, the superior manufacture and variety of which commanded universal approbation."

The Ransomes ploughs on show this year included a self-lift tractor disc model, called the "Hussar," a four-furrow version of which is illustrated by the engraving Fig. 12. This

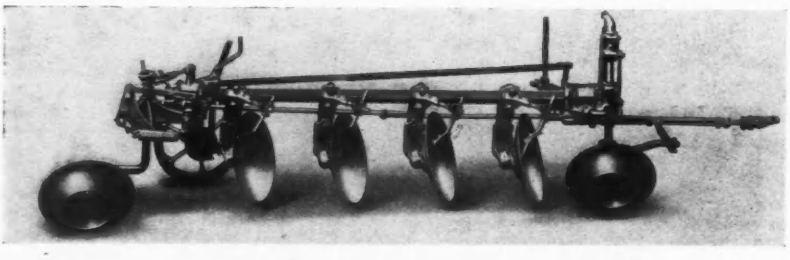


FIG. 12—FOUR-FURROW DISC PLOUGH—RANSOMES

plough, which was in the export section of the exhibit, has been designed for light and medium soil conditions and, in addition to that illustrated, two, three, five and six-furrow models are being produced. The beam, which is of heavy square section high-carbon steel, forms the backbone of the plough, the disc standards being clamped to it. The discs, which are also of high-carbon steel, are ground to a sharp cutting edge and are normally of 24in diameter, though 26in discs can be fitted, if desired. One of the features of the "Hussar" is the dustproof furrow wheels, the design of which has resulted from extensive experiments in the field. The sharpness of their rims helps when hard land has to be penetrated, whilst the width of the flanges prevents the wheels from sinking into the ground when working in soft conditions. The land wheel is adjustable, by means of setscrews on the rear main casting, so that it can be given a bias towards or away from the ploughed land. Depth adjustment is effected by a hand screw and lever which are conveniently placed. It is stated that the "Hussar" requires from 2 to 4 drawbar horsepower, or up to 450 lb drawbar pull per disc, according, of course, to the width and depth of ploughing.

Another exhibit which attracted attention on this firm's stand was a working model of the Ransomes-Davies crop drier. In Fig. 13 there is reproduced a general view of the company's B.C.D. 9/7 general-purpose drier. This equipment has an overall length of 66ft, a width of 20ft 11½in and a height, excluding the vent to atmosphere, of 10ft. The grass, or other material to be dealt with, is carried through the drier on a moving conveyor consisting of roller chains and interlocking perforated sections, which are jointed at suitable intervals to form a continuous moving band. The conveyor drive consists of a pawl and ratchet driving unit operated by a large cam, the final reduction being through spur gearing. The conveyor speed is controlled by a single lever, the pawl and ratchet unit having a range of seven speeds, and three speeds being available for the cam, giving in all twenty-one different rates of travel, from 2·2in to 45·25in per minute, for the conveyor. Power for the conveyor is provided by a 2 h.p. electric motor.

The drier furnace is normally arranged for oil burning, and air is supplied by three fans, which are independently driven through vee belts by separate motors, No. 1 fan requiring an 18 h.p. motor, No. 2 fan a 14 h.p. motor and No. 3 fan a 12 h.p. motor. Drying is effected on a three-stage principle. The No. 3 fan draws hot gases from the furnace and cold air from the atmosphere in controlled quantities. After passing through the fan this mixture at 220 deg. Fah. is blown through the bed of grass in the third stage of the drier. No. 2 fan then draws the gases which have passed through this stage, and also further hot gases from the furnace, and the mixture at 260 deg. Fah. is blown through the bed of grass in the second stage of the drier. The process is repeated by No. 1 fan, from which a mixture of gases at 300 deg. Fah. is blown through the bed of grass in the first stage of the drier and is finally discharged to atmosphere outside the building housing the equipment. Cold air is drawn through the grass as it leaves the drier, the reclaimed heat passing into the air system. The drier, it may be added, can be conveniently converted to deal with grain.

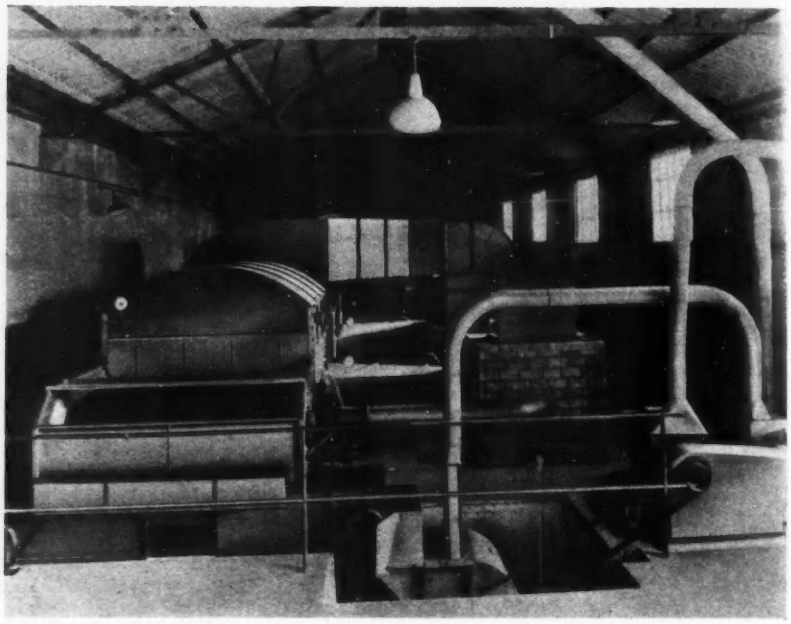


FIG. 13—GENERAL PURPOSE CROP DRIER—RANSOMES

(To be continued)

Technical Reports

Road Research Technical Paper No. 19, "*Snow Fences.*" Published for the D.S.I.R. by H.M.S.O., price 1s. 9d.—The paper, which has been prepared by the Road Research Laboratory, explains how and why snow fences can be placed to prevent highways becoming blocked by snow drifts. The explanation of the mechanics of drifting is of considerable interest. The blocking of highways by snow is not such a major problem in Britain as it is in other countries as, for example, Scandinavia, but the sums spent on snow clearance are an indication of the seriousness of the problem. In one county alone between £30,000 and £125,000 is spent annually in keeping its highways open to traffic during snow. Much of this expenditure is unavoidable, but some of it would probably be saved by erecting snow fences along the line of the road. The snow, which falls directly on the highway does not usually cause the most trouble to traffic, especially as considerable progress has been made in Britain with the development of machines and organisations for removing snow from the carriageway.

The paper gives the results of a survey of existing literature on the subject. The survey was undertaken partly so that British highway authorities should have all the available information and partly as a preliminary to experiments in this country. The publication explains how drifts are formed, the various types of snow fences and the arrangement of fences to suit particular sites and conditions. Although intended primarily for road authorities, "Snow Fences" should also be of interest to railway authorities.

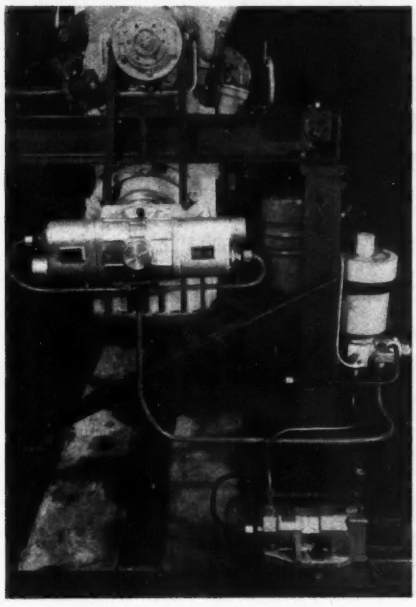
A Hand-Hydraulic Engine Starter

ACCOMPANYING illustrations show the construction of a new engine starting device, of which Bryce Fuel Injection, Ltd., of Staines, Middlesex, has recently acquired manufacturing rights. Capable of application to all types of engine, but particularly useful for starting oil engines, the device is known as the Bryce-Berger "Handraulic" starter. As its name implies, the starter is hand operated, power being stored and released when required by a hydraulic accumulator. Working within a closed circuit, the starter relies on no outside source of energy and it has only three moving parts—two toothed racks and a pinion.

The hydraulic accumulator consists of a small reservoir containing a synthetic rubber diaphragm. The reservoir is filled initially with air compressed to about 2000 lb per square inch, and it is then sealed. As there can be no leakage and the air is not consumed, the accumulator never requires recharging with air. When air only is in the accumulator, the diaphragm rests against the inside walls of the reservoir. Hydraulic fluid is pumped into the lower part of the accumulator by a hand-operated pump so as to compress the air at the back of the diaphragm to about 4000 lb per square inch. The diaphragm completely isolates the air from the fluid and in its charged state the pressures on both sides of the diaphragm are equal, so that it is not subjected to strain.

The starter unit itself consists of two opposed cylinders, each containing a piston rack which engages with a simple pinion. This pinion is integral with a toothed dog which engages with a corresponding dog on the engine crankshaft. The teeth of the pinion and racks are helical so that a forward movement is imparted to the pinion, thus engaging the dogs during the first stage of the starting operation.

On releasing the control lever, the energy stored in the high-pressure air in the accumulator is transmitted through the medium of the hydraulic fluid to the starter. The control lever operates a two-stage valve, the first stage admitting sufficient pressure to the starter to engage it with the crankshaft. During the second stage, when the dogs are fully engaged, oil at full pressure is admitted to the heads of the piston racks and the crankshaft is rotated at high speed and with a high starting torque. The action of the starter resembles a sharp pull up on the starting handle, but it is, of course, applied with much greater speed and torque.



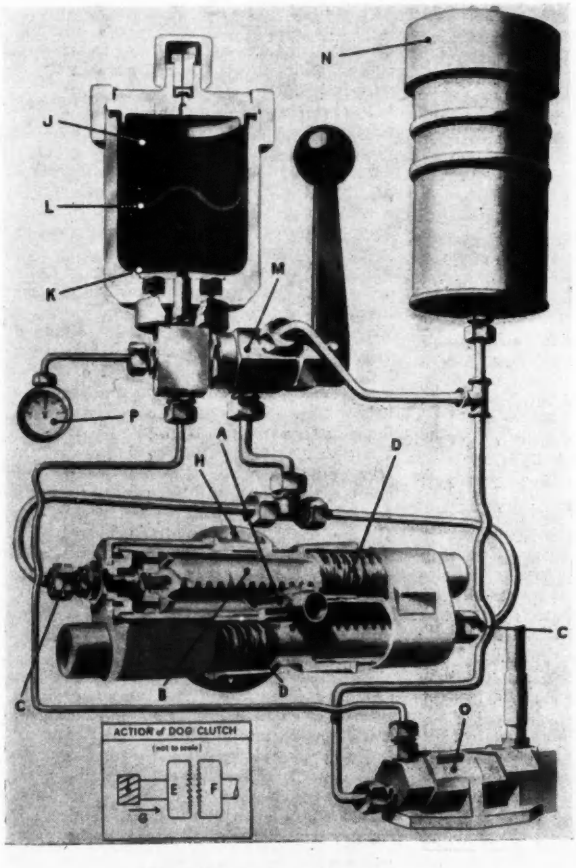
STARTER FITTED TO 150 B.H.P. OIL ENGINE

When the engine starts, the dogs are automatically disengaged and, on the release of the control lever, the piston racks return to their original positions under the influence of return springs, thus discharging the fluid to the feed tank ready for pumping up to the accumulator for further starts.

Building up the fluid pressure in the accumulator, which is not always necessary after every start, is normally carried out by the hand pump. This operation is said to take no more than a minute or so. If desired, a small mechanical pump can be fitted so that, once the engine has started, the accumulator fluid pressure will be recharged automatically. The hand pump is, however, always available when required. In most applications the design permits a starting handle to be passed through the centre of the starter unit for engagement with the crank in the usual manner.

An interesting result of the design is that by using only the first stage of opening of the operating valve the engine can be "inched" over as may be required for timing purposes. The efficiency of the starter is claimed to be unaffected by temperature changes.

One of our illustrations shows the "Handraulic" starter fitted to a Meadows six-cylinder 150 h.p. oil engine on a test rig.



ARRANGEMENT OF STARTER

A Driven pinion with helical teeth.

B Piston rack driving pinion *A*.

C Hydraulic fluid inlets.

D Piston-rack return springs.

E Driving dog on common shaft with pinion *A*.

F Driven dog on crankshaft.

G Axial thrust due to helical teeth of piston rack and pinion.

H Starter mounting flange.

J Hydraulic accumulator.

K Diaphragm containing compressed air.

L Diaphragm under hydraulic pressure.

M Relay starting valve.

N Hydraulic fluid reservoir.

O Hand pump for charging accumulator.

P Pressure gauge.

British Standards Institution

All British Standard Specifications can be obtained from the Publications Department of the Institution at 28, Victoria Street, London, S.W.1.

BALL BEARINGS AND PARALLEL-ROLLER BEARINGS

No. 292 : 1950. This standard was first published in 1927. The present revised edition has been prepared in order that this standard might be brought into line with current practice. The principle modifications which have been made are as follows: the tables of tolerances on overall dimensions and the permissible errors due to eccentricity and wobble have been revised. New series of extra light journal bearings and extra light single thrust bearings have been included in sizes which form an extension of the former small extra light series. Single-row angular contact ball bearings are included in a comprehensive range of sizes and types.

The journal bearings standardised are of the following types: rigid single-row ball journal bearings, single-row angular contact ball bearings, self-aligning double-row ball journal bearings, rigid parallel-roller bearings, and ball journal bearings, magneto (detachable) type. The ranges of sizes covered for the journal bearings are from ½in to 20in bore in the inch series and from 4mm to 150 mm bore in the metric series.

The thrust bearings standardised are of the following types: single-thrust ball bearings with flat seatings, single-thrust ball bearings with spherical seating rings, double-thrust ball bearings with flat seatings, double-thrust ball bearings with sleeves. The ranges of sizes covered for the thrust bearings are from ½in to 20in bore in the inch series and from 10mm to 150mm bore in the metric series. In the majority of the series of both journal and thrust bearings provision is made for extra light, light, medium and heavy types. Whilst corresponding series in both inch sizes and metric sizes are given for the majority of the types of bearings covered by the standard a recommendation is made that, in the interests of simplification of standards, users in preparing new designs should adopt metric size ball bearings and parallel-roller bearings in preference to inch size bearings.

The present edition includes the system of reference symbols, which appeared in the first edition and which is now suitably extended to cover the new additional types of bearings which are included. The present revision is issued to meet the urgent need for an up-to-date standard to replace the 1927 edition, which has been out of print for some time. The committee responsible for its preparation is, however, actively engaged in a consideration of further matters, such as diametral clearance and recommendations for a limitation in the variety of types and sizes of bearings—particularly thrust bearings, and it is expected that a further edition of the standard, of enhanced value to users, will be issued at an early date. The preparation of a further British Standard for precision ball bearings and parallel-roller bearings has also been put in hand. Price 6s., post free.

Fourth World Power Conference

No. I

THROUGHOUT this week the World Power Conference has been holding technical sessions and social evening functions in London. This international organisation was created in 1924 when the first World Power Conference was held at Wembley, becoming thereafter a permanent body with an international secretariat. Two further full-scale conferences were held before the war, one at Berlin in 1930 and another at Washington in 1936; and a number of "sectional meetings" have also been held, the latest and the only post-war one being held at the Hague in September, 1947, for the discussion of fuel economy. The meeting in progress during the current week was thus the Fourth World Power Conference.

Technical sessions for the presentation and discussion of the very large number of papers originating from very many countries have been held in the halls of the Institutions of Civil, Mechanical and Electrical Engineers. The opening session took place last Monday in the Central Hall, Westminster, and the same evening there was a reception by H.M. Government at the Science Museum. Technical sessions began last Tuesday morning and continued until to-day. On Tuesday evening there was a reception at the Guildhall, and last night an official banquet took place at Grosvenor House. Tomorrow a Closing Session will be held in the Great Hall of the Institution of Civil Engineers. All next week many of those who attended the conference will be dispersed upon a number of "study tours" that will take them to nearly all parts of this country.

So large a number of papers was presented at this, the Fourth World Power Conference, that it has embarrassed us to decide how best to deal with them. Fortunately, in accordance with what is now a common practice, the organisers of the conference appointed a number of "reporters" who each reviewed a group of papers constituting a single section. Those "general report" papers have been made available to us and they both summarise and comment upon the material contained in the original papers. Even so, the "general reports" alone constituted an indigestibly large amount of material. We have had, therefore, to abstract from those reports and even to omit reference to some of them. In what appears below we have been careful to include section reference letters, so that readers may be aware of those sections with which abstracts do not deal.

The various sections and reference letters are as follows.:—

A.—"Energy Resources and Power Developments."

B.—"Preparation of Solid Fuels" (Sub-Sections 1, Coal; 2, Lignite Brown Coal and Peat; 3, Coke).

C.—"Preparation of Liquid Fuels" (Sub-Sections 1, Petroleum; 2, Diesel and other liquid fuels).

D.—"Preparation of Gaseous Fuels (Sub-Sections 1, Natural Gas and Gas from Liquid Fuels; 2, Gas from Solid Fuels).

E.—"Production of Steam Power" (Sub-Sections 1, Developments in Power Station Design; 2, Steam Generation; 3, Turbines and Auxiliaries).

F.—"Internal Combustion Engines."

G.—"Gas Turbines and Jet Engines."

H.—"Water Power" (Sub-Sections 1, Resources and Location of Plant; 2, Design of Power Stations; 3, Aspects of Plant Design).

J.—"Atomic Energy."

K.—"Other Sources of Energy."

SECTION A.—ENERGY RESOURCES AND POWER DEVELOPMENTS SINCE 1924

By R. Y. Sanders, F.S.S., F.R.Econ.S., F.R.Met.S.*

The twenty-six papers which form the massive foundation for discussion at this Session come from countries together covering almost 30 per cent of the world's area, and 40 per cent of its population.

The general pattern of resources and development disclosed by these papers is already familiar to many, but the papers provide an informative factual background, and raise many individual points inviting discussion. There are some general topics which might fruitfully be pursued. The world picture as a whole is one of rapid exploitation of resources; despite the set-back and dislocation resulting from the second world war, development since 1924 has been faster then ever before, and seems almost to conform to an exponential law of expansion. The main world power resources so far exploited are, of course, the trinity of coal, oil and its attendant natural gas, and water-power. Only the latter is perennial, and while some countries are more fortunately situated than others, the rate of extraction of the first two gives rise to anxiety as to the future power position, unless, as is to be discussed in another session, atomic energy within a measurable period comes in to redress the exhaustion of the world's heritage of conventional subterranean energy resources.

Even the water-power situation is not without its question marks. Climatological changes, which may or not be permanent, are affecting glacial reserves and precipitation in some parts of the world. The more readily accessible sources—from the standpoint both of economic construction and of proximity to markets—have naturally received prior attention, and future development in many cases will be less favourable.

The period has been one of great technical advance in the fuel economy of prime movers and generators. While the expansion in the use of power has led to a remarkable advance in human productivity, it is for consideration whether the efficiency of application of energy has kept pace with technical progress in production.

The development of high-voltage transmission has also been remarkable. Interchanges of energy across national boundaries, which were rare in 1924, have now become of practical value in many parts of the world in relieving the lack of balance between capacity and requirements, which is the outcome of the world's uneven distribution of population and power resources. Voltages of transmission lines have risen steadily and, with them, their economic radius of supply. The question of the foreseeable limits of economic transmission is one of continuing interest, because upon it depends the possibility of effective development of many of the energy resources located remote from consuming centres.

Finally, some of the papers show that the possibilities of other perennial sources of energy, such as wind and tidal power and solar radiation are now the subject of expert examination and scientific experiment; progress and prospects in these fascinating fields will be of widespread interest.

SECTION D2.—PREPARATION OF GASEOUS FUELS—GAS FROM SOLID FUELS

By J. G. King, O.B.E., D.Sc., Ph.D., A.R.T.C., F.R.I.C.†

Underground Gasification

In France, exploration of the possibility of producing a lean gas by underground gasification is proceeding in three phases: (1) Collaboration in the international experiments on a practical scale at Bois-la-Dame; (2) Field experiments at Djerada in Eastern Morocco; and (3) Laboratory research at their Montluçon Station (paper No. 3). The paper contains technical information from the last two sources only.

At Djerada, experiments have been made with the gasification of good-quality anthracite. A horizontal coal panel in the seam has been selected, to which shafts have been sunk at a distance of 330ft apart. Ignition of the coal is obtained by the combustion of fuel oil at about 10 lb per minute. The conditions of the experiment have been decided by theoretical considerations which are set out in the paper and which have been based upon published Russian data. The first experiments conducted in November, 1949, showed the necessity for working at a fairly high pressure of about 8·2ft of water, while theoretical calculations have indicated that air-preheating to about 750 deg. Fah. would be necessary if a gas were to be obtained with a calorific value as high as 90 B.Th.U. per cubic foot. At this high pressure there is a danger of the fire spreading out of control through the surrounding strata. The first experiments have not provided complete data, but gasification rates as high as 166,000 cubic foot per hour have been achieved.

At Montluçon, investigations on scale models have helped to guide the Moroccan experiments and have been conducted with specially arranged fire zones, in which the cross-section of the gasification channel is maintained constant. The theoretical considerations of this work are given in some detail in the paper; it has been verified that the movement of the fire is positive in the backwards direction towards the air inlet, and is much slower and more variable in the direction of gas flow. Some data has been collected which give a lead towards operation on a larger scale, although it is admitted that the correlation may be difficult. Studies have also been made of the influence of humidity of the surrounding minerals or rock in deciding the rate of loss of heat from the fire zone. It is now proposed to study the kinetics of the rate of reaction of carbon dioxide with a heated solid coal wall, with particular reference to diffusion of gas and preheat temperature.

SECTION E1.—PRODUCTION OF STEAM POWER—DEVELOPMENTS IN POWER STATION DESIGN

By J. D. Peattie, B.Sc., A.C.G.I., M.I.E.E.‡

The eight papers in this section fall into two groups. In the first, the papers from South Africa, Portugal, the Netherlands and Great Britain describe generating stations and plant existing or under construction in the respective countries, while the paper from Switzerland gives particulars of certain definite installations designed to meet modern conditions. In the second group, the papers from France, Poland and Hungary, discuss, in more general terms, problems relating to power station location and design. All three authors refer to the application of their studies to conditions in the countries concerned.

Fuel Supplies.—Most authors make repeated reference to the use of low-grade or low-volatile fuel. South Africa uses, at stations on her coalfields, low grade fuel which is available there at very low prices. Her better-quality fuel is sent by rail from the Transvaal to the Cape. Ney, in his calculations and diagrams, shows very clearly the importance of calorific value of fuel as a factor in the calculation of the most economical position for power plant. Simões discusses in some detail the interesting and varied problem facing Portugal in securing the optimum balance between higher-quality fuel imported by sea, low-grade native anthracite, low-grade native lignite, wood, and various vegetable waste products of comparatively low calorific value. Although the scale of operation in Portugal may be dwarfed by that of other countries, the treatment of the subject by Simões is of exceptional interest owing to the wide range of fuels in question. The Netherlands are preparing to use imported fuel with a wide range of characteristics. The volatile content may vary from 6 per cent to 30 per cent, with ash content up to 20 per cent. The British paper makes reference to the variation in fuel quality over a very wide range, and to the increase in ash content.

Boiler Design.—Arising out of the use of low-grade or low-volatile fuel and the rapid increase in capacity of plant and of stations, special attention is given by authors to the problems associated with the design and performance of boilers and ancillary plant.

Gastpar describes a number of installations specially designed for the use of lignite, or low-

* Deputy Commercial Manager, British Electricity Authority.

† Director, the Gas Research Board.

‡ Deputy Chief Engineer (Generation), British Electricity Authority.

grade or low-volatile coal. He refers on page 6 of his paper to the adoption of unit boilers each 360,000 lb to 470,000 lb per hour capacity to supply 50MW turbo-alternators. The case is of interest in the light of the doubts expressed by some authors regarding availability of large boilers.

Reay refers to the need for close consideration and co-operation between coal mining and power supply authorities, in balancing costs of providing better quality coal against costs of using inferior quality coal. In South Africa the solution of this problem is greatly influenced by the very low pit-head cost of coal, and the relatively high capital costs of power stations.

Kruk gives 336,000 lb per hour as the limiting output of single pulverised fuel boilers which may be called upon to burn extreme qualities of imported coal. As a result, two such boilers are required to feed the Standard Netherlands turbo-generator of 50MW to 60MW capacity. This boiler output is also a practical size for low-volatile coal.

Sóváry sums up the difficulties facing the introduction of the unit system in many countries by noting that :—

(1) There is no type of boiler available at which the yearly operating hours would even approximate to the operating time of turbine generators, and even the foremost boiler manufacturers will not give guarantees concerning the yearly operating time of boilers.

(2) From the industrial point of view, to a turbine generator of the most economical size would correspond a boiler capacity of such magnitude that the planning and building could not be undertaken by this same industry.

Pask refers briefly to the increasing use of comparatively low-grade fuel in Great Britain, and agrees with Sóváry that the problem of boiler availability and size is a serious one. He refers, however, to the work of the British Boiler Availability Committee, which now enables boiler manufacturers to design large-capacity boilers which should be able to achieve higher availability than hitherto. The majority of the new British plant is, therefore, designed on the unit principle. Pask gives particulars of the British boilers under construction. Of these, 210 smaller boilers with capacities between 150,000 lb and 265,000 lb per hour are mainly chain-grate stoker-fired, with some spreader stokers and pulverised fuel firing. The remaining 236 larger boilers with capacities between 300,000 lb and 830,000 lb per hour are pulverised fuel fired. Some 73 per cent of the total capacity is pulverised fuel fired.

The various authors are all conscious of the flexibility of pulverised fuel firing, and favour it particularly for larger boilers. At the same time, they are aware of its limitations for low-volatile coals.

In South Africa and Portugal, greater emphasis is laid on the use of chain-grate stokers. Conditions in these two countries are somewhat exceptional. In South Africa, coal is very cheap and the problems of ash disposal and grit emission are not at all pressing. In Portugal the average size of boilers is considerably less than that discussed by authors from other countries.

Ash and Grit Disposal.—As a result of the increasing use of lower-grade coal, the removal from the boiler and handling of ash and flue-gas dust and their subsequent disposal are major problems in several countries.

South Africa is apparently the most fortunate, since disposal from open veldt stations is relatively easy. Reay does, however, mention changes at the Congella station. When the first stage of this station was constructed, the built-up housing area was reasonably remote, and the dust amount small. Growth of load and development of the built-up area have made it necessary to install modern precipitators, and ash dams have been formed for land reclamation.

Ney discusses the difficulties arising from disposal of ash and dust and from the presence of sulphur compounds in the flue gases. He concludes that large power stations should be located in sparsely populated areas some distance from large towns. He refers to the difficulties in finding suitable waste ground for the disposal of ash and dust, and to research into means for using slag and ash for building materials.

In Britain use is made of electrostatic precipitators and multicyclone grit arresters, but Pask agrees that the provision for economical disposal of the ash and dust residue is one of the main requirements in the selection of a generating station site. He mentions the use of ash and dust for land reclamation. In the case of sites on the coast, disposal is effected by dumping at sea.

At three London stations flue-gas washing plant has been or will be used for the removal of sulphur compounds. The cost of installation and operation are very high, and research on this problem continues.

Cooling Water Supplies.—While certain authors make no reference to this problem, others regard it as of major importance.

In South Africa suitable rivers are scarce, and at times there are objections to the use of those which are suitable. Use is made of sewage effluent and of water pumped from the mines for cooling purposes. In certain cases, in order to avoid temperature rise with direct cooling, river water is used as make-up for cooling towers. At the coast, sea water is used for direct cooling.

Ney analyses in some detail the comparative costs, under Polish conditions, of placing a generating station at the coal mine or on an adjacent river. He comes to the conclusion that it pays to place the station on the river and to use direct cooling, rather than locate it at the pit using cooling towers.

It is interesting to compare this conclusion with Reay's note regarding the Vierfontein station. A careful examination of the economics, under South African conditions, of a river-side site with direct cooling or, alternatively, of siting the station at Vierfontein coal field 8 miles from the river showed there would be little or no economic advantage in the river-side site. Reay points out the importance in this case of two factors ; namely, the low cost of fuel, and the substantial expenditure on civil works for direct cooling at the riverside site.

Pask regards the provision of adequate water supply as generally the most difficult requirement to be satisfied in selecting a station site in Great Britain. Coastal sites have high civil engineering costs. Estuary sites have foundation difficulties, and only the larger rivers are suitable for direct cooling. As a result, increasing use is being made of sewage effluent, which will be used by 13 per cent of the post-war plant now under construction.

The South African, Polish and British authors refer briefly to cooling-tower design, and there is an interesting note in Reay's paper about the use in South Africa of spray cooling augmented by surface cooling over the large area of effluent ponds.

Choice of Steam Conditions.—Gastpar places the improvement in steam conditions as the first time in his list of technical means of securing greater economy, and gives specific examples of installations up to 2133 lb per square inch, 968 deg. Fah.

So far as South Africa is concerned, Reay draws attention to the low cost of fuel and the distance of the stations from manufacturing resources. These factors, and the less simple operating and maintenance requirements of high steam pressures and temperatures, justify a conservative policy in regard to design.

New plant for the Netherlands is being designed for 850 lb to 1000 lb per square inch and 895 deg. to 915 deg. Fah.

In Great Britain, 81 per cent of the new plant is being designed for two standard conditions : 600 lb per square inch, 850 deg. Fah., and 900 lb per square inch, 900 deg. Fah. To encourage development, a certain amount of new plant will operate at advanced steam conditions between 1235 lb per square inch, 825 deg. Fah., and 1500 lb per square inch, 1050 deg. Fah.

Relation Between Loads, Size of Units, and Size of Stations.—The French paper deals with fundamental considerations, and analyses the influence of various factors in arriving at the most economical size of unit and the optimum capacity of a power station. The analysis is extended to cover the largest capacities of units and stations now under consideration.

The Hungarian paper also discusses a similar problem in determining the most economical relation between boiler and turbine capacity. In this case, the results are used to determine the units to be used in a station of more moderate size.

Ricard starts with certain assumptions regarding the relation between size and cost of station turbo-alternators and boilers.

He pursues his arguments to determine the optimum size of unit (1) with existing heavy interconnection, and (2) with interconnection, the cost of which has to be taken into account. He arrives at the conclusion that stations should be designed :—

(*a*) with a single unit for the supply of regions with low load density ; and

(*b*) with several groups of 100MW for stations in high load density regions.

A further investigation leads him to the optimum values of installed capacity and spacing of stations against load density. He calls attention to the reasons which in practice limit the application of his studies.

Sóváry approaches the problem from a somewhat different angle, and calculates when it pays to augment boilers and turbo-generators. He further shows that it always pays to interconnect units consisting of one boiler and one set with each other.

The Netherlands and British authors give particulars of the plants which their countries have under construction during the next few years. The tendency towards the use of larger machines, as advocated by Ricard's curves, is obvious. In the Netherlands, 60MW is the maximum capacity for the near future, while in Great Britain a considerable number of 60MW and a few 100MW machines are under construction.

(To be continued)

An Electronic Computer

"SEAC"—the National Bureau of Standards Eastern Automatic Computer—was completed in Washington recently and has commenced to work for the Scientific Computation of Optimum Programmes (SCOOP) project of the United States Air Force. It multiplies or divides eleven-digit numbers in 250 one-millionths of a second and is described by its inventors as the fastest computer in operation. In describing "SEAC" the National Bureau of Standards has avoided direct comparisons with the capabilities of other electronic computers, either in operation or planned, but considers the new equipment the first automatically sequenced, super-speed computer to be put into useful operation. Making the computer handle a "mathematical model," or set of equations, of Air Force operations, in conjunction with conventional punched card computing equipment, it has already been possible to compute, in a few months, budgeting and requirements data which formerly required years to develop by normal staff procedures.

The new computer has four main sections—an input-output unit, a "memory" unit, a control unit and an arithmetic unit. In the performance of its basic operations, the unit can modify its instructions, ascertain if it has made any errors and determine when it has computed results to a predetermined accuracy. It can add or subtract eleven-digit numbers at the rate of 1100 times a second, multiply or divide them at the rate of 330 times a second. These speeds include the time required to search the "memory" for the numbers, operate upon them and return the result to the "memory." Instructions and numbers can be fed into the electronic input unit at the rate of 1,000,000 pulses a second.

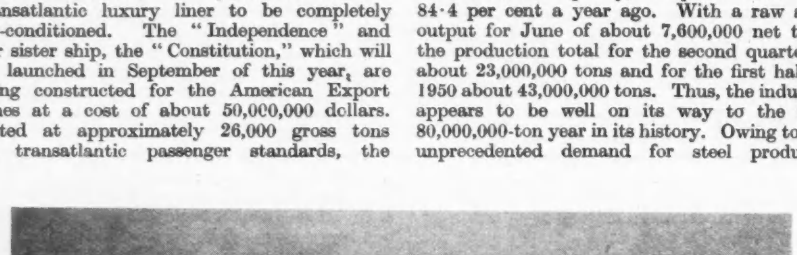
Cycle and Motor-Cycle Show.—The twenty-sixth International Bicycle and Motor-Cycle Show is to be held at Earls Court, London, in November, 1951.

American Engineering News

(From Our Own Correspondent)

New Passenger Liners

RECENTLY the S.S. "Independence" was launched at the yard of the Bethlehem Steel Company at Quincy, Massachusetts. This is the largest passenger vessel to be constructed in this country since the war and is also claimed to be the fastest vessel in the American merchant marine, as well as the first transatlantic luxury liner to be completely air-conditioned. The "Independence" and her sister ship, the "Constitution," which will be launched in September of this year, are being constructed for the American Export Lines at a cost of about 50,000,000 dollars. Rated at approximately 26,000 gross tons by transatlantic passenger standards, the



ARTIST'S IMPRESSION OF S.S. "INDEPENDENCE"

"Independence" is 683ft in length, has a moulded breadth of 89ft and will draw 30ft when loaded. Both shafts together develop a total of 55,000 h.p. at 150 r.p.m. The accompanying illustration shows the appearance of the completed vessel. There are nine decks, a single mast, having a height of 89ft above the sports deck and two funnels, 41ft high, and having approximately 360 square feet of cross section. First, cabin and tourist-class accommodation is provided, and the total passenger capacity is 1000.

Scheduled for a trial run off the New England coast in mid-December, the "Independence" is guaranteed by her builders to deliver a top speed of 25 knots. Upon completion in January, 1951, the ship will enter the New York–Mediterranean express service and is expected to make the 4000-mile crossing to Genoa in less than eight days. The vessel has a 22,000-mile cruising radius, and, in times of emergency, will be capable of transporting 5000 troops and their equipment. The air-conditioning plant is capable of providing 184,540 cubic feet of air per minute, used to condition for humidity as well as for temperature the passenger accommodation and the entire quarters for the 578 members of the crew. The lay-out and design of staterooms and public rooms is in line with conventional practice, and two large swimming pools for first and cabin-class passengers and a salt water cascade for tourists are provided.

Other important passenger vessels under construction include the 15,000-ton liner "President Jackson," which was launched at the yard of the New York Shipbuilding Corporation, at Camden, New Jersey, on June 27th, and which is expected to be ready for trial runs in January, 1951. It is the first of three 12,000,000-dollar luxury liners being constructed for the American President Line's round-the-world service. All three liners will have a length of 536ft, offer accommodation for 204 first-class passengers in air-conditioned staterooms, and have a cruising speed of 19 knots. Defence features incorporated in the design of the liners include fixtures for the launching of paravanes, mine-sweeping devices and convertibility to facilitate the transport of 2500 troops.

Steel Industry Production Records

At the turn of the half-year it is becoming evident that the steel industry of the United States will establish production records for both the second quarter and the first six months of 1950. The industry is operating currently at a rate of 101·2 per cent of theoretical capacity, compared with only 84·4 per cent a year ago. With a raw steel output for June of about 7,600,000 net tons, the production total for the second quarter is about 23,000,000 tons and for the first half of 1950 about 43,000,000 tons. Thus, the industry appears to be well on its way to the first 80,000,000-ton year in its history. Owing to the unprecedented demand for steel products, several major steel companies have announced plans for basic expansions. At the end of last year, the industry's 2,000,000,000 dollar post-war expansion programme was nearing completion, with only about a further 500,000 tons of new ingot capacity to be installed in 1950. It is now expected that new ingot capacity amounting to at least 2,000,000 tons will be installed this year, with possibly a similar increase in 1951. By the end of 1950 the industry will probably have an ingot capacity exceeding 90,000,000 tons per annum. Despite this tremendous potential, the end of the current shortage of steel, particularly sheet products, is not yet in sight. Recently, large orders were placed by American metal products works for steel supplies, including lots of more than 1000 tons of steel plate, to be obtained from such Netherlands mills as the Royal Dutch Blast Furnace and Steel Company, which itself is being assisted by the Economic Co-operation Administration. At the present time, there is also an acute shortage of steel melting scrap in the United States, and the Carnegie-Illinois Steel Corporation of Pittsburgh has just announced the purchase of some 100,000 tons of high-quality steel scrap from Germany.

Three Large Tankers

The "Atlantic Seaman," the first of three sister ships being constructed for Philadelphia Tankers, Inc., was launched recently at the Delaware River yard of the New York Shipbuilding Corporation. The vessel, which is described by the builders as the world's largest tanker, has an overall length of 659ft 6in, a beam of 85ft, and a draught of just over 34ft. At this draught, the displacement will be about 36,000 tons. The capacity of the cargo tanks will be 257,900 barrels and the bunker tanks will hold 21,000 barrels. The vessel is scheduled to be completed early in September, and is to be chartered and operated by the Atlantic Refining Company of Philadelphia.

All of the three tankers will have spacious deck houses, with stateroom accommodation for a crew of approximately fifty officers and men. The vessels have single screws, driven by Westinghouse steam turbines of the cross-compounded double reduction gear type, designed to develop 18,000 s.h.p. maximum at a speed of 103 r.p.m. The four-bladed propellors are 22ft in diameter. Motor-driven centrifugal cargo pumps will be capable of discharging a full cargo of oil in approximately twelve hours.

Highway Paving Tests

A project has been commenced by New York City authorities to test natural, processed and synthetic rubber in the building of heavily travelled roads. Each of the three types of rubber is being mixed separately with asphalt paving; natural rubber at an average content of about 1 per cent and processed and synthetic at an average content of $\frac{3}{4}$ per cent. For purposes of comparison, four 100ft sections of the West Side Highway of Manhattan have been paved with the three mixtures and with plain asphalt. The natural rubber used comes from Dutch Indonesian plantations, the processed rubber has been obtained principally from grinding up of over-age motor vehicle tyres, and the synthetic product was contributed by the Goodyear Company. It is hoped to demonstrate the rubber-containing pavings' improved resistance to extreme temperatures, non-skid properties, increased life and reduced maintenance and ability to withstand shock and vibration.

Dedication of Shasta Dam

Only a few weeks after President Truman had dedicated the world's largest concrete dam, Grand Coulee, on the Columbia River in Washington, he participated, *in absentia*, in the dedication of the second greatest dam, Shasta. The dam extends nearly three-quarters of a mile across the valley of the Sacramento River, at the topmost end of the Central Valley of California. It rises to a height of 602ft and contains the major hydro-electric power plant within the State of California. The objectives of Shasta Dam include flood control and navigation as well as power development. Water from the streams of Northern California is stored and made to enter a network of canals hundreds of miles long to help irrigate the arid areas at the southern end of the Central Valley.

Manhattan Midtown Crossing

Two alternative plans to deal with the increasing traffic congestion in central Manhattan are at present being discussed by civic authorities of New York City. The City Planning Commission has approved funds for an engineering study of a crosstown vehicular tunnel to be situated in the vicinity of Thirtieth Street. Such a tunnel would connect the Lincoln Tunnel under the Hudson River with the Queens-Midtown Tunnel under the East River. An elevated toll highway, connecting both tunnels as well as the existing elevated West Side and East River Highways, has been proposed as an alternative by the Triborough Bridge and Tunnel Authority. The estimated cost of a crosstown tunnel has been put at 67,000,000 dollars, and that of an elevated highway at 40,000,000 dollars. In either case the facility would require the payment of tolls.

Radio-Active Pipe-Line Tracer

Radio-active trace materials produced at the atomic energy laboratories at Oak Ridge, Tennessee, and diluted in oil are now being used on a commercial scale by the Standard Oil Company of California. Whenever a pump changes the product being pumped through a petroleum pipe-line, a fraction of an ounce of the diluted tracer liquid is added to the oil stream between the two products, so that as this junction of the two products moves along the line, the tracer moves with it. At the point of delivery, sensitive detection instruments using Geiger counters attached to the pipe respond to the arrival of the tracer, thus informing the operator of the change in product about to take place. The trace material is said to be self-destroying and absolutely safe.

Industrial and Labour Notes

Gold and Dollar Reserves

The Chancellor of the Exchequer, Sir Stafford Cripps, made a statement in Parliament on Wednesday of last week concerning the gold and dollar position at the end of the June quarter. In the course of it he said that the sterling area's net gold and dollar surplus during the quarter had amounted to 180,000,000 dollars, compared with a surplus of 40,000,000 dollars in the first quarter, and a deficit of 31,000,000 dollars in the fourth quarter of 1949. Receipts under the European Recovery Programme, Sir Stafford continued, amounted to 240,000,000 dollars and 18,000,000 dollars were drawn on the Canadian credit. At the end of June, the gold and dollar reserves stood at 2422 million dollars compared with 1340 million dollars at the lowest point immediately before devaluation.

Later in his statement, Sir Stafford emphasised that it was essential that our reserves of gold and dollars should be adequate for their purpose. Although they had increased, those reserves were still far below the level necessary to enable us to face with equanimity all the sudden and substantial changes in external conditions which might take place. Their further strengthening was a matter of the highest importance. For that reason, Sir Stafford observed, it was necessary to maintain those policies of restraint in respect both to personal incomes and expenditure, especially on dollar imports, at the same time providing the maximum encouragement to dollar earnings, which had contributed so much to recovery during the past nine months.

Railway Wages

It was announced last week-end that the Railway Executive had made an offer of a wage increase from 92s. 6d. to 96s. a week for the lowest paid railway workers, with an adjustment for clerical staff at a corresponding level. It will be recalled that the National Union of Railwaymen recently put forward a claim for £5 a week minimum wage for the lower-paid grades. The Railway Executive's offer, of course, is applicable to all three railwaymen's unions and not only to the N.U.R.

Details of the offer were given to the annual meeting of the N.U.R. at Morecambe last Saturday. It was stated subsequently that the offer had been accepted on the understanding that it was "without prejudice to any further claim for all grades." Rather more than a year ago the N.U.R. made a claim for a general wage increase of 10s. a week and rejected an offer by the Railway Executive—similar to that now accepted—of an advance in the wages of the lower-paid grades.

Britain's Overseas Trade

Speaking in the debate on the Third Reading of the Finance Bill in the House of Commons on Monday, the Chancellor of the Exchequer stated that the provisional value of United Kingdom exports in June was £175,900,000. June was a month of twenty-five working days, the Chancellor observed, and if the export figure was adjusted to the standard month of twenty-six working days, it was slightly above the record total for May.

The provisional value for imports in June, the Chancellor added, was £238,600,000, and of re-exports, £6,200,000. The excess of imports over exports and re-exports was, therefore, £56,600,000, giving an adverse visible balance for the first half of this year of £220,500,000. That figure, the Chancellor said, compared with an adverse balance of £199,100,000 in the first half of 1949 and £230,400,000 in the second half of last year.

Coal Production

Lord Hyndley, chairman of the National Coal Board, visited the annual conference of the National Union of Mineworkers at Llandudno on Thursday of last week, and in the course of an address to the delegates said that in the three years of public ownership the yearly output of coal in this country had increased by over 20,000,000 tons. That, he considered, was good as far as it went. During that time, Lord Hyndley added, much had been done to improve the wages and conditions of those employed in the coal-mining industry. Many of the improvements had been accorded by the Board as an act of faith—faith in the ability of the mining community, through its efforts, to ensure that the improvements could be justified to the nation.

Lord Hyndley then made reference to the Coal Board's annual report for 1949, and pointed out that the financial deficit had been reduced by £9,500,000. But, he said, he had hoped that it would be better, and he thought it should be possible to get rid of the remaining £12,000,000 deficit this year. The cost of producing coal was still high, and although it was encouraging to find that production costs had been reduced by 6d. a ton last year, further improvement was necessary. The latest figures, Lord Hyndley regretted to note, were not so promising. The need for more coal production, he continued, was as insistent as ever. Home coal consumption continues to rise, industry was for ever demanding more electric power or gas, so that it could increase the quantity and efficiency of its output, and, abroad, the demand for those kinds of coal for which British coalfields had been famous in the past was still unsatisfied.

Finally, Lord Hyndley expressed the hope that, before very long, the Board and the union would be discussing together the Board's long-term programme of capital investment, or, as it was called, the "National Plan" for the industry. More than once it had been said that the industry's future depended to a very great extent on the intelligent investment of new capital. That capital, which could not, of course, be got without paying for it, must be spent not only intelligently, but successfully, which meant that all engaged in the industry must give all the help and support of which they were capable.

Suggestion Schemes

The Industrial Welfare Society has published this week the third edition of a useful booklet dealing with works suggestion schemes. It is claimed to be a survey of the best of current practice in the promotion and adoption of suggestions.

The booklet includes information on obtaining suggestions, considering and adopting them, and gives also some guidance on methods of encouraging suggestions. That information is preceded by a chapter setting out the aims and objects of suggestion schemes. Two of the objects, the booklet says, should be to arouse interest on the part of employees in the firm and its products, and to secure their full co-operation in the enterprise, and to train employees to think along constructive lines in order to make themselves more proficient in their work.

Suggestion schemes, the booklet asserts, afford one useful basis for practical co-operation between management and workers. One of the disturbing features of the growth of industry has been the tendency for the worker to become more and more an accessory to the machine. In a foreword to this booklet, the fact is deplored that "pride in craft, which sprang from the consciousness of having created something and which was one of the main constituents of human happiness, has unfortunately been lost to many workers." The Industrial Welfare Society believes that, despite the limitations of modern industrial practice, suggestion schemes can restore to the worker some measure of initiative and make him feel that he can participate in improving the efficiency and general well-being of his firm.

The booklet, which costs 2s. 6d., is obtainable from the Society at 48, Bryanston Square, London, W.1.

Canada and British Exporters

Mr. James Duncan, who is the chairman of the Dollar Sterling Trade Board of Canada, and president of the Massey-Harris Company, Ltd., has contributed to the latest issue of the *F.B.I. Review* a forthright article setting out some important points which British exporters should keep clearly in mind in the efforts to capture Canadian markets. This article, it should be added, has been prepared by Mr. Duncan at the request of the Federation of British Industries, which asked that the weak points in the British dollar sales drive should be emphasised. Mr. Duncan agrees that if some of the "difficulties mentioned can be steadily eliminated, the result will be an early achievement of the objective to which we are all working."

In one section of his article Mr. Duncan says that purchases of equipment for modernisation, expansion and new development reflect the general optimism of Canadian industry at this time. Rapid delivery of orders, therefore, is often more important than price. While the Canadian industrialist is as anxious as anyone else to buy at the best price possible, he will not take the chance of delays in his programme, which may leave him behind his competitors, merely to save a little on original cost of fixed assets. If British machinery manufacturers are to make any substantial gains in the Canadian market, Mr. Duncan declares, they must be able to make deliveries as promptly as their competitors in the U.S.A. He then emphasises that good servicing and repair facilities are as important as prompt deliveries. Many Canadian companies, Mr. Duncan asserts, have hesitated to purchase British machines, despite excellent general operating qualities and favourable price, through fear of what may happen in the event of a breakdown. The availability of spare parts and efficient repair services on short notice are essential to the sale of capital equipment in Canada.

Another point to which Mr. Duncan directs attention is that the Canadian buyer of machinery places a relatively low value on longevity and a relatively high value on immediate efficiency. British industry, the article says, has long been proud of manufacturing machines and other goods to last a lifetime. But the Canadian buyer is more interested in a machine which will give him lower unit costs immediately, or greater production per man or machine hour, or an improved product or rate of wastage. His interest in the machine's performance a decade or two hence is often secondary, Mr. Duncan thinks, for the Canadian buyer probably expects to replace it much earlier with a new and more efficient machine which he confidently expects to be available.

Iron and Steel Production

In its latest statement on iron and steel production, the British Iron and Steel Federation shows that the total output of ingots and castings in the first six months of this year was 8,309,000 tons. This, the Federation says, established an all-time record for any six-month period, and was 351,000 tons above the production in the first half of 1949. Steel output in June averaged 312,500 tons a week, and was thus at an annual rate of 16,249,000 tons. In June, 1949, steel production was at an annual rate of 15,645,000 tons.

Pig iron production during June averaged 182,200 tons weekly, which represents an annual rate of 9,474,000 tons. Over the first half of this year pig iron output averaged 184,800 tons a week, or an annual rate of 9,611,000 tons, compared with a rate of 9,442,000 tons in the first half of last year.

French Engineering News

(From our French Correspondent)

Production of agricultural machinery by the Sté. Française de Matériel Agricole et Industriel, at Vierzon, was 50 per cent higher at the end of 1949 than in the best of previous months. This was due to a sustained effort at modernisation of equipment, reorganisation of factories, and rationalisation of working methods. As a result of considerable demand for 25-30 h.p. tractors, the company has reached an agreement with the Forges et Ateliers du Creusot for the supply of mechanical parts for tractors of this type. First deliveries will take place this year and will enable production at the Vierzon factory to be doubled. In the course of 1949, the company produced three prototypes for harvester-thresher tractors. Test results have been encouraging, and a new series for the 1950 harvest has been launched. A final type is to be established with either an auxiliary motor, a drawn machine or self-propelling machine. The design of a 15-18 h.p. tractor is also in hand to meet the demand for lower power equipment.

* * *

On the question of coal policy, Monsieur Louvel, Minister of Commerce, has indicated that average French coal consumption over the next few years may be estimated at 70 million tons, of which 55 million tons will be of French origin and 15 million tons from abroad. The Minister stated that the cost price must be lowered and that mines which were uneconomic would be closed. Out of the sixty-six small non-nationalised mines, he said, twenty-five will inevitably have to be closed because their coal is of poor quality or because costs are too high.

Additional information has just been issued about a competition started by Charbonnages de France for furnace equipment using Lorraine coal. Tests will be made at the Laboratory of the Foundry Industries Technical Centre in the presence of a representative of the constructor, who may, if he wishes, himself regulate the equipment presented. Characteristics of fuel used will be as follows: moisture, 7 to 8 per cent; ash, 8 to 10 per cent; volatile matter, 35 to 39 per cent; fixed carbon, 43 to 50 per cent. There will be three tests: one over a prolonged period burning normally, the second with the apparatus overloaded and the third, a prolonged test at reduced load. Following the third test, a check will be made at normal load. Emissions by the apparatus will be taken into account; opaque, yellow or brown-black smoke will be allowed only for the first ten minutes after lighting up. Afterwards the smoke should be colourless or light grey.

* * *

Owing to reduced demand, production by the steel industry has dropped 30 per cent since last year. Fourteen French and two Saar blast-furnaces have been shut down, and production has only been maintained at its present level by a rise in exports. Steel exports in May amounted to 261,000 tons out of a total Franco-Saar production of 590,000 tons of finished goods.

* * *

A group of fourteen French engineers has left France for an eight-week study of working organisation in the United States. This is the twenty-third French group to be sent to America under the technical assistance programme. The fourteen specialists are in charge of rational organisation of work in some 500 French firms annually and represent four professional organisations. On their return the engineers will propagate American productivity methods. There are in France about 350 companies specialising in scientific organisation of work. Each has between five and forty progress engineers. There are, in addition, about 100 progress engineers working on their own.

* * *

Marshall Aid credits have been granted to the Ets. J. J. Carnaud for the equipment of the firm's Basse-Indre factory, whose tinplate production is to be doubled. Electric motors and part of the mechanical equipment have been ordered from French constructors and import of other material from America, including 62-ton rolls, has started.

Notes and Memoranda

Rail and Road

FESTIVAL BUSES FOR EUROPE.—It is announced that four London red double-decker buses of the latest type will leave the United Kingdom on July 28th on a 4000-mile tour of Western Europe to publicise the Festival of Britain, 1951. The tour will last until October and will cross eight countries. The buses have been placed at the disposal of the Festival Organisation by the London Transport Executive. Three of them have been converted into exhibition galleries. The fourth will carry the staff, baggage and spares. The buses will carry their usual London Transport markings in addition to the Festival symbol. The national flag of the country visited will fly alongside the Union Jack at each showing. The public will be able to walk through the exhibition and to obtain information about the 1951 programme.

Air and Water

NEW OCEAN TERMINAL AT SOUTHAMPTON.—The Railway Executive announces that the Prime Minister, the Right Hon. C. R. Attlee, C.H., has accepted an invitation to perform the opening ceremony of the new Ocean Terminal Building at Southampton docks on Monday, July 31st. The new terminal has been designed to cater for passengers embarking and disembarking from the largest ocean liners, including the "Queen Elizabeth" and the "Queen Mary." It is a two-storey building equipped on the upper floor with waiting halls and Customs examination halls, and on the lower floor an island platform for boat trains and facilities for dealing with passengers' cars.

Miscellanea

BUILDING WEEK IN LEEDS.—The Government, the building industry and the associated professions are to combine in presenting another Building Week, to be held in Leeds from September 11th to 16th of this year. The primary purpose of the Week is to show the latest developments in building and the ways in which new methods, new materials and machines can raise output and reduce costs. Another aim of the Week is to stimulate recruitment to the industry, particularly of apprentices. It will be somewhat larger in scope than the Building Week held in Tunbridge Wells last September and will be staged in the open air on Hunslet Moor, which is about one mile from the centre of Leeds.

THE BRITISH INTERNAL COMBUSTION ENGINE RESEARCH ASSOCIATION.—At the recent annual general meeting of the British Internal Combustion Engine Research Association, Viscount Falmouth, M.I.Mech.E., was re-elected President for 1950–51. Lieutenant-General Sir Frederick G. Wrisberg, K.B.E., Dr. S. F. Dorey, F.R.S., Air Commodore F. R. Banks, C.B., Sir Lynden Macassey, K.B.E., K.C., and Major-General Clayton, C.B., were re-elected Vice-Presidents. The Engineer-in-Chief of the Fleet, Vice-Admiral (E) the Hon. D. C. Maxwell, C.B., was also elected a Vice-President. Mr. J. Jones, M.I.Mech.E., of the National Gas and Oil Engine Company, Ltd., was re-elected Chairman of Council.

PACKAGING MATERIALS.—The Waste Paper Recovery Association says that shortage of packaging materials is causing serious concern to manufacturers throughout the country. Many firms are already handicapped in production, both for the home market and for export, and the position threatens to grow worse. The demand has already outstripped the normal supply of waste paper by many hundreds of tons each week, and stocks have dwindled alarmingly to four weeks' supply. The Association is therefore appealing especially to all engaged in industry to see that every scrap of used and unwanted paper is recovered, and it will give any information about the matter. Its address is 52, Mount Street, London, W.1.

A CENTRELESS GRINDING HANDBOOK.—A new handbook has been prepared by Arthur Scrivener, Ltd., Tyburn Road, Birmingham, for engineers interested in centreless grinding. The book, which is issued free of charge, is a continuation of the first handbook on the subject which was published some four years ago. It deals with recent developments in centreless grinding equipment, the latest types of machines, and describes many methods of automatic operation and the production obtainable with their adoption. Many excellent illustrations and detailed drawings add considerably to the interest and value of the information given in the book. All who are concerned with centreless grinding will find much to interest them in this well-produced publication.

"TUBE WORKS GAUGES AND GAUGING PRACTICE."—An interesting little book, entitled "Tube Works Gauges and Gauging Practice," has been prepared by Stewarts and Lloyds, Ltd., for the use of its works trainees. This book in simple, straightforward language, deals with all aspects of gauging practice as applied to tube manufacture. It is well illustrated with photographs and drawings and contains two appendices, one giving a comprehensive series of definitions of terms relating to screw threads, and the other gives detailed notes on tolerances and limits. The book is published at 5s. net and can be obtained from the company's offices, Brook House, Upper Brook Street, London, W.1.

FILMSTRIPS ON INDUSTRIAL HISTORY.—Three filmstrips, entitled "The Steam Engine (up to 1805)," "Liverpool to Manchester," and "Early Locomotives," have been produced recently by Unicorn Head Visual Aids, Ltd., 40, Broadway, Westminster, S.W.1. The first records the origin of the steam engine and its development up to the beginning of the nineteenth century; the second deals with the early history of the Liverpool and Manchester Railway, and the third portrays early attempts at locomotive design and locomotive developments in more recent years. These filmstrips are intended for use primarily in the upper forms of modern and grammar schools, the National Committee for Visual Aids having collaborated in their preparation.

FAULTS IN ARC WELDS.—The British Welding Research Association has just issued a publication "Memorandum on Faults in Arc Welds in Mild and Low Alloy Steels," which is a reprint from its journal, "Welding Research." In this memorandum typical faults which can occur in arc welds in mild and low-alloy structural steel construction are defined and illustrated; an outline is given of the reasons for their occurrence, and of the ways in which they may be avoided and corrected. To assist engineers, inspectors and welding supervisors in making reference to a particular detail, each weld fault is dealt with under the following common sub-headings:—description, cause and prevention, effect on strength, correction. Copies of the memorandum can be obtained from the Association at 29, Park Crescent, London, N.W.1, price 2s. 6d. net.

B.E.A. POWER STATION CONTRACTS.—The British Electricity Authority has now received the consent of the Minister of Fuel and Power to the development of four new power stations to their full capacity. The stations are East Yelland, near Barnstaple; Connah's Quay, in Flint; Acton Lane, Willesden, London; and Brighton "B." The Minister's consent has already been given for the initial installations of plant in these stations, which, with the exception of Brighton "B," will each have a total installed capacity of 180,000kW when completed, made up of six turbo-alternator sets of 30,000kW. The total installed capacity of Brighton "B" station when completed will be 330,000kW, made up of four turbo-alternator sets of 52,500kW and two sets of 60,000kW. The further construction work now sanctioned will be spread over a number of years, no dates having been yet fixed for the completion of the stations.

CENSUS OF DISTRIBUTION.—The draft of a new Order which will provide further safeguards against the disclosure for official use of information supplied by traders under next year's Census of Distribution has been laid before Parliament by the Board of Trade. The non-disclosure provisions of the Statistics of Trade Act, 1947—the Act under which the Census will be taken—contain an exception allowing the President of the Board of Trade to authorise disclosure to other Government Departments or to the Import Duties Advisory Committee of details from individual returns made under the Census. The President has already told Parliament that information collected for the Census would be treated as strictly confidential. The new draft Order implements that assurance by forbidding the disclosure of any information relating to particular undertakings without the written consent of the person concerned except for the purposes of taking the Census, preparing the Census report, or taking any proceedings under the Act. There should therefore be no possibility of knowledge of individual returns being available outside the Census of Distribution office, even to other Government Departments or to other divisions of the Board of Trade, except for the purpose of taking proceedings under the Act or with the consent of the person concerned. The disclosure of individual particulars in any published reports of the results of the Census is already forbidden by the Statistics of Trade Act itself.

British Patent Specifications

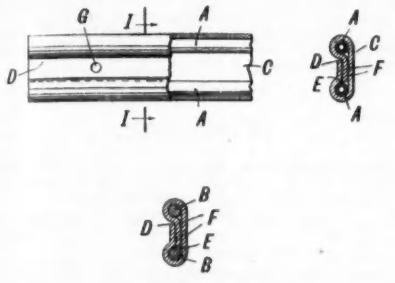
When an invention is communicated from abroad the name and address of the communicator are printed in italics. When an abridgment is not illustrated the specification is without drawings. The date first given is the date of application; the second date, at the end of the abridgment, is the date of publication of the complete specification.

Copies of specifications may be obtained at the Patent Office Sales Branch, 25, Southampton Buildings, Chancery Lane, W.C.2, 2s. each.

ELECTRICAL ENGINEERING

38,025. June 10, 1947.—ELECTRICAL CONDUCTOR UNIT, John B. Pierce Foundation, of 40, West 40th Street, New York City, 18, New York, U.S.A.

This invention relates to electrical wiring systems, and in particular to an electricity conductor unit of simple and inexpensive construction, having a hard, scuff-proof outer sheath, and adapted for mounting on a wall or other exposed location. In the parent patent No. 561,728, there is disclosed an electricity conductor unit which comprises the combination of a tubular outer sheath of rigid insulation material, for example, of vulcanised fibre known in the trade as "Vulcoid," with electricity conductors positioned in this sheath so as to provide a rigid web insulatedly separating the conductors. In this invention the unit comprises a pair of electrical conductors disposed in longitudinally



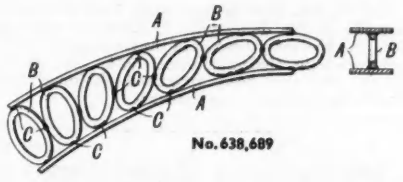
No. 638,025

spaced side-by-side relationship within an integral hard and rigid sheathing which encloses the conductors and provides a hard and rigid spacing web between the latter, the sheathing being formed of a strip of material whose longitudinal marginal portions are folded over the conductors, so that one marginal portion overlaps the other and are securely laminated upon the body of the strip between the conductors. The drawings illustrate electrical conductors *A* or *B* insulatedly mounted within an outer casing of sheathing *C*, which is advantageously of vulcanised fibre or like insulating material of suitable surface hardness and rigidity. They may be tubular or solid rods. The outer casing or sheathing *C* of the unit is formed from an initially flat strip of a yieldable material which sets under pressure to hard, tough, rigid and durable condition, possessing the required electrical insulating characteristics. The conductors are laid side by side in spaced longitudinally parallel alignment on the inner surface of a strip of the fibre, or other suitable material, in its initial flexible condition prior to the setting operation. The longitudinal margins *D*, *E* of the flexible strip are thereupon turned upwardly and inwardly and folded over the conductors *A* or *B*, so that these margins overlap so as to form, with the portion *F* of the strip between the conductors, a three-ply laminated assembly. As thus arranged, the flexible assembly is run through a processing equipment which exerts pressure upon the material to harden and rigidify the same in final assembly. Openings *G* may be provided through the web.—*May* 31, 1950.

STRUCTURAL ENGINEERING

638,689. January 13, 1948.—IMPROVEMENTS IN OR RELATING TO GIRDERS AND LIKE CONSTRUCTIONS, Nils Birger Henrik Sundman, of 27, Strandvägen, Stockholm, Sweden.

This invention consists essentially in having the stiffening members of girders in the form of oval rings or discs which are easily adjusted in the process of assembly to suit different or varying distances between the main members by merely rotating them in a plane extending across the space between the main members. Referring to the drawings, the parts *A* are the longitudinal main members of a girder, consisting for instance of metal strips. These strips may be curved or straight according to the shape of the girder construction required; as illustrated they are curved and converge towards one another so as to form a curved beam of gradually decreasing depth from one end to the other. The main members *A* of this beam are spaced apart by stiffening members in the form of oval rings *B*—for instance, metal rings—which are rigidly attached to the members *A* and to one another as shown, so as to form a rigid frame. In the construction of a metal girder according to the invention, it is most convenient to attach the stiffening members to the main members and to one another by welding. The welds are indicated in the drawings by the reference letter *C*. Owing to the fact that the stiffening members *B* are of oval shape, they are



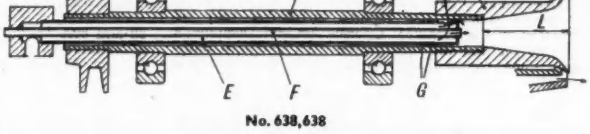
No. 638,689

readily adaptable to different or varying distances between the main members by merely rotating them in a plane extending across the space between the main members. A girder of gradually diminishing depth can therefore easily be constructed with stiffening members which are all of the same dimensions by angularly adjusting each stiffening member to suit the distance between the main members at the point where the stiffening member is inserted. Modified constructions for frame girders and X-shaped and hexagonal masts are also illustrated.—*June* 14, 1950.

OIL BURNER SPRAYERS

638,638. June 25, 1947.—IMPROVEMENTS IN OR RELATING TO LIQUID FUEL BURNERS, N.V. de Bataafsche Petroleum Maatschappij, of 30, Carel van Bylandtlaan, The Hague, The Netherlands.

This invention relates to liquid fuel burners of the kind wherein a stream of fuel delivered on to the inner wall of a rotating cup is atomised and burned in a stream of air surrounding the lip of the cup. In the accompanying drawing *A* denotes a cup secured on one end of a hollow shaft *B* which is rotatable in suitable bearings, such as the ball races *C*, and is provided with a pulley *D* or other suitable driving means. A conduit *E*, disposed within the hollow shaft *B*, supplies liquid fuel to the inside of the cup through a port F, suitable sealing means, such as the washers or glands *G*, being provided between the conduit *E* and the shaft *B* to prevent leakage of the fuel into the shaft. Air for atomisation and combustion is supplied through



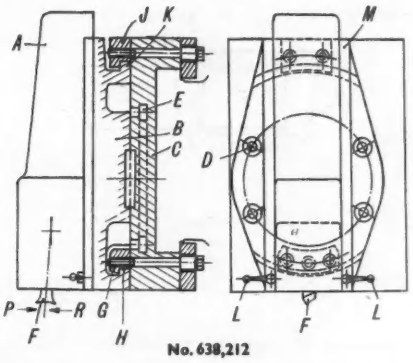
No. 638,638

an annular nozzle *H* surrounding the outlet of the cup. Disposed within the fuel conduit *E* is a further conduit *F* which supplies a stream of auxiliary air axially into the inside of the cup *A* to prevent soot formation. Since this auxiliary air is not required to constitute any substantial part of the air required for combustion normal aspiration of air from the atmosphere is generally sufficient, but the conduit *F* may, if desired, be connected to a source of air under pressure. In order still further to enhance the anti-fouling properties of the burner, the internal surface of the cup *A* is preferably provided with a smooth finish—for example, by polishing—or may be provided with a smooth coating—for example, by chromium-plating. Preferably, the interior of the cup is of substantially conical shape, the angle of slope being not less than corresponds to an apical angle of 12 deg., the distance *L* being somewhat greater than the diameter of the lip of the cup.—*June* 14, 1950.

MACHINE TOOLS

638,212. August 26, 1947.—CLAMPING ARRANGEMENT FOR THE TOOL CARRIER OF SLOTTING, PLANING, SHAPING AND LIKE MACHINE TOOLS, Charles William Berthiez, of 43, Avenue Paul Doumer, Paris 8e, France.

This invention concerns a clamping arrangement for the tool carrier of slotting, shaping, planing and like machine tools. The drawings show an elevational part sectional side view of a machine tool carriage constructed in accordance with the invention and an end elevation. It will be seen that the tool slide on carrier *A* and the quadrant *B* have, during normal forward cutting operation in the direction *P*, a tendency to bear against the saddle C of the cross slide which slides over a cross rail, whereas during the return stroke illustrated by the arrow *R*, the slide or carrier and the quadrant have a tendency to disengage the saddle if no special clamping means are provided. In the arrangement illustrated a central clamping system is disposed in a circle concentric with the axis of the quadrant and comprising bolts *D*, the heads of which engage a circular T groove *E* provided in the saddle so as to



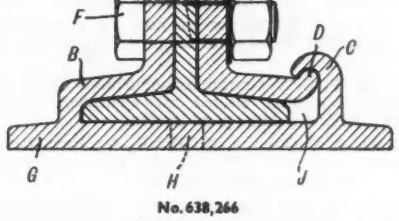
No. 638,212

permit adjustment of the angular position of the quadrant with respect to its axis. The clamping means are associated with supplementary means for clamping the lower edge of the quadrant *B*, lying in the vertical direction as near as possible to the cutting edges of the tool *F*. They consist of a flanged strip or plate *G* bolted to the saddle *C* and associated with an arcuate flange *H* integral with the quadrant and its axis. This second clamping means, which is similar to that described for the lower part of the quadrant, comprises an upper peripheral clamping system, constituted by a flanged strip of plate *J* bolted to the saddle *C* and tightly engaging a co-operating arcuate flange *K* formed on or integral with the rear of the quadrant. Thus the quadrant is perfectly clamped without any possibility of movement or of producing any difference in position for the cutting tool between its forward and rearward movements.—*June* 7, 1950.

RAILWAY ENGINEERING

638,266. June 28, 1948.—IMPROVEMENTS IN RAIL JOINTS, Nicolaas Revers, of Molenweg 30, Limmen, North Holland, the Netherlands.

Referring to the drawing, contiguous with the left side of the rail *A*, is a fishplate *B* shaped according to the form of the rail and subsequently bent so as to pass below the base thereof. The portion of the fishplate which passes below the rail base terminates in an upstanding edge portion which is bent inwardly and upwardly to form a hook-shaped portion *C* which embraces an upwardly bent beaded edge *D* of the fishplate *E*. The two fishplates *B* and *E* are connected with each other and with the rails *A* by means of bolts *F*. The portion of the fishplate *B* which passes below the base of the rail *A* is provided with flanges *G*, which may be used for securing the rail joint to a sleeper. At the position of the joint between the rail ends there is



No. 638,266

provided an opening *H* for discharging water and other deposits. As shown in the drawing, the rails are entirely enclosed at the sides and below, so that on the one hand the track will be perfectly straight at the joint, while, on the other hand, any giving of the rails is positively prevented. With this construction there is no heavy strain on the bolts, particularly if the joint is supported by sleepers, and by locating the locking means *D* and *C* above the face of the rail a free space *J* is left

adjacent the rail face whereby the fishplate *E* can be turned away in an outward direction when dismantling the joint.—*June* 7, 1950.

TUBE AND PIPE COUPLINGS

638,000. October 10, 1946.—IMPROVEMENTS IN COUPLING MEANS, Keeseal Pty., Ltd., of Kent Road, Mascot, near Sydney, Australia (assignees of Gordon Keech, of 14, Morella Road, Clifton Gardens, near Sydney).

This invention relates to coupling means wherein male and female members are held together and a

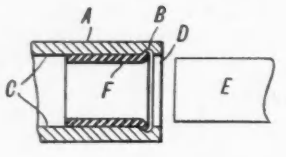


Fig.1

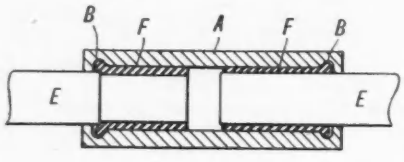


Fig.2

No. 638,000

joint is made by a sleeve of resilient material such as rubber, natural or synthetic, interposed between the male and female members. Fig. 1 shows one end of a coupling in longitudinal section with a pipe positioned to be entered therein; Fig. 2 shows a double end coupling in longitudinal section with two pipes positioned for insertion. The coupling member *A* has an internal groove *B*. Inwardly from the groove the internal diameter of the coupling member as indicated at *C* is greater than the diameter at the end *D*. The end forms an internal shoulder which is a working clearance on the pipe *E*. The rubber sleeve *F* is inserted in the coupling member and the end of said sleeve entering the groove *B* forms a flared or bellmouth entry, while the confluence of the inner edges of the grooves and the pipes forms the loci of initial anchorage for the sleeves as stated above. A lubricant is applied to the internal wall of the rubber sleeve. Fig. 2 shows a double end coupling for joining two pipes in axial alignment and it shows one of the pipes in position. The reference numerals in this figure indicate the same parts as in Fig. 1. It will be seen that when the pipes are inserted the rubber sleeve is expanded longitudinally. This expansion in the outward direction presses the rubber into the grooves *B*, and by reason of the internal shoulder at the end of the coupling member the rubber forms a wedging compressive lock on the pipes *E*.—*May* 31, 1950.

Personal and Business

MR. ARTHUR H. WAINE, A.M.I.Mech.E., F.I.M., has been appointed a director of Hadfields, Ltd.

EARL DE LA WARR, P.C., has joined the board of the Brush Electrical Engineering Company, Ltd.

MR. J. C. DICKINSON has been appointed works manager of Brockhouse Engineering (Southport), Ltd.

MR. E. S. WADDINGTON, of Philips Electrical, Ltd., has been elected vice-chairman of the BEAMA arc welding plant section.

MR. A. C. GOODER, M.I.Mar.E., has been elected president, and Mr. F. S. Bowen, vice-president, of the Engineer Surveyors' Association.

SIR FRANK H. NIXON has resigned from the board of John Brown and Co., Ltd., Mr. S. W. Rawson has been appointed a manging director of the company.

THE UNION CASTLE LINE announces the appointment of Mr. William Lockhart as Commodore Chief Engineer, in succession to Mr. F. C. Ruse, who has retired.

THE MORSE CHAIN COMPANY, Ltd., Letchworth, Herts, states that, following the retirement of Mr. A. E. Phillips, its Birmingham area representation is now in charge of W. Lewthwaite and Sons, Ltd., Fletcher's Chambers, 10, Fore Street, Birmingham, 2 (telephone, Midland 7029). Mr. T. Harland Yarrow has been appointed agent in the North Wales area. His address is "Harleth," 67, Forest Road, Great Meols, Hoylake, Cheshire.

DR. T. EMMERSON has been appointed Director of Research for the Guest Keen Nettlefolds group of companies. He has been acting director of the G.K.N. laboratories since last October.

THE HAWKER SIDDELEY ORGANISATION, Ltd., announces the following appointments:—Mr. M. N. Golovine, A.F.R.Ae.S., A.C.G.I., Aero Sales director, Armstrong Siddeley Motors, Ltd., and Mr. C. A. G. Hicks, sales co-ordination manager, Hawker Siddeley group.

MR. ALAN S. BUTLER has retired from the chairmanship of the de Havilland Aircraft Company, Ltd. He became a director of the company in 1921, and has been chairman since 1924. Mr. F. T. Hearle has now been appointed chairman and Mr. W. E. Nixon, deputy chairman.

Forthcoming Engagements

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of their insertion, the necessary information should reach this office on, or before, the morning of the Monday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

British Association

Wed., Aug. 30th, to Wed., Sept. 6th.—Annual meeting in Birmingham.

Institution of Metallurgists

To-day, July 14th, to Sat., Sept. 30th.—Science Museum, South Kensington, London, S.W.7, Exhibition, "Metals in the Service of Mankind," weekdays, 9.30 a.m. to 6.30 p.m.; Sundays, 2.30 p.m. to 6.30 p.m.

Institution of Sanitary Engineers

To-day and Sat., July 14th and 15th.—Annual summer meeting in Manchester.

Old Centralians

To-day, July 14th.—Chez Auguste Restaurant, 47, Frith Street, W.1, "A Travel Talk—Out and About," H. L. Bullock, 12.55 p.m.

Stephenson Locomotive Society

Sat., July 15th.—Visits to Ashford Works and Running Shed, British Railways, S.R., 3 p.m. (Midlands); March, S. Lynn and King's Lynn sheds from 10.45 a.m.

Sat. and Sun., July 22nd and 23rd.—Tour of Running Sheds, Bristol, Newport and S. Wales Area. Scottish members visit Carstairs Depot.

Reports on German and Japanese Industry

Additional summaries of those reports on German industry which were not considered suitable for printing are listed below. The reports themselves may be inspected at the Technical Information and Documents Unit by quoting the appropriate F.D. reference numbers. Photo-copies of the reports can be made available at cost.

No. of report	Title
F.D.1782/49	Iron-Zirconium Alloys and Zirconium Steels: Kaiser Wilhelm Institut für Eisenforschung, Clausthal-Zellerfeld.
F.D.1739/49	Instruction Sheet for the Treatment of Steels: Oberkomanndo der Kriegsmarine (Supreme Command of the German Navy), Berlin.
F.D.1736/49	Cromadur and Tinidur Heat-Resisting Steels: Reichastelle Eisen und Metalle (Reich Office for Iron and Metals), Berlin.
F.D.148/50	German "JLO Werke" Two-Stroke Gasoline Engine: JLO Werke H. Christiansen, Pinneberg, near Hamburg.
F.D.128/50	Description and Evaluation of a Free-Piston Engine: Luftfahrtforschungsanstalt Hermann Goering (Herman Goering Institute for Aeronautical Research), Brunswick.
F.D.2724/49	Drawings of a Dr. F. Porsche, Light-Wheeled Tractor: Volkswagenwerk G.m.b.H., Wolfsburg.
F.D.1088/49	Reports on Steam and Gas-Turbine Developments: M.A.N., Maschinenfabrik Augsburg-Nürnberg A.G., Augsburg.
F.D.187/50	Turbine Ceramic Bucket and Wheel Development Project: M.A.N., Maschinenfabrik Augsburg-Nürnberg A.G., Augsburg.

The German Coal Tar and Benzole Industries During the Period 1939–1945. B.I.O.S. Sub-Committee Surveys Report No. 25. H.M. Stationery Office. Price 5s. 6d.—This account of the German coal tar and benzole industries has been compiled largely by collating the information contained in relevant reports emanating from the British Intelligence Objectives Sub-Committee (B.I.O.S.), the corresponding American body, Field Information Agency, Technical (F.I.A.T.) and the combined Anglo-American agency, Combined Intelligence Objectives Sub-Committee (C.I.O.S.). These reports were drawn up by individuals or by teams who shortly after the war investigated German manufacturing and marketing methods.

Most of the tar distilleries discussed in the survey were visited by several different teams of investigators and were therefore described in several reports. For this reason it was found difficult in the present publication to make direct references to the source from which the information was obtained. It was accordingly decided to omit references and to include as an appendix a bibliography of the individual reports on which this report is based. So far as possible the survey includes all the important information contained in the individual reports, thus reducing the need for the usual system of references.

Most of the German works suffered very considerable war damage and as a result the operations previously carried out therein have been considerably modified or in some cases discontinued. Moreover, during the period immediately following the war such plants as were operable were working with very much reduced throughputs since, in the absence of war demands, a large part of the industry was at a standstill. The descriptions given in the report of the various works plant and processes relate mostly to pre-war and war-time conditions, and may not now be applicable, but the information should provide a basis for comparison with technical developments in this country.

The Technical Information Documents Unit (T.I.D.U.) has moved to Lacon House, Theobald's Road, London, W.C.1 (Tel.: Chancery 4411). Reports, documents and other records of German wartime industrial developments will continue to be at the disposal of interested British firms. T.I.D.U. will also continue to disseminate to British industry research reports which have been made available by the U.S. Government for this purpose, to arrange for the publication of Selected Government Research Reports, and to act as National Centre for the United Kingdom in the O.E.E.C. Documents' Exchange scheme.

Catalogues

MANCHESTER OIL REFINERY (SALES), Ltd., 44a, Dover Street, London, W.1.—Leaflet describing "Supramor Galactol E.P." soluble cutting oil.

PROTOLITE, Ltd., Central House, Upper Woburn Place, W.C.1.—Catalogue No. P. 17, "New Standard Tools: Cemented Tungsten Carbide Tipped."

CHASESIDE ENGINEERING COMPANY, Ltd., Station Works, Hertford, Herts.—Folder describing improvements to mobile mechanical handling equipment.

EVERETT, EDGCUMBE AND CO., Ltd., Colindale Works, Colindeep Lane, Hendon, London, N.W.9.—Catalogue sheet 485/5001, dealing with electric speed meters.

BRITISH INDUSTRIAL PLASTICS, Ltd., 245, Oxford Street, London, W.1.—Technical leaflet concerning the use of beetle resin "W 20" for bonding foundry sand cores.

METROPOLITAN-VICKERS ELECTRICAL COMPANY, Ltd., Trafford Park, Manchester.—Publications dealing with "Industrial Fittings," "Fluorescent Fittings" and "Streetlighting Fittings."

HENRY WIGGIN AND CO., Ltd., Wiggin Street, Birmingham, 16.—Booklets entitled "K Monel Physical and Mechanical Properties"; "Nickel Alloy Spring Materials"; "Notes on the Hot-Working of Nimonic 80 and 80A"; "Notes on the Annealing and Pickling of Nimonic 75 and 75F," and "Notes on Machining the Nimonic Series of Alloys."

Contracts

THE CROWN AGENTS FOR THE COLONIES have placed an order for a research trawler with Hall, Russell and Co., Ltd.

CENTENARY OF EXORS. OF JAMES MILLS, LTD.—A very fine centenary catalogue has been issued by the Exors. of James Mills, Ltd., of Bredbury Steel Works, Woodley, near Stockport, to show the range of its products and give a brief history of the firm. When James Mills went into business on his own account in 1850 at the early age of twenty-three years, he started in a small outbuilding at a Stockport works. He first built two machines of his own design and then, with the aid of two employees, started to manufacture engineer's keys. The foundations of the now well-known firm were firmly established by 1860, when Mills commenced to manufacture solid and split taper pins. When the founder of the firm died, in 1869, he left a small but thriving business to his two sons. Tom Hampden Mills and James Edward Mills. The company was called by them the Executors of James Mills, and when it was registered as a limited company in 1900 the shortened title now in use was adopted. The site of the present works was acquired in 1874, when the premises at Stockport became inadequate. In the years which followed the range of products and size of the works steadily grew, and extensions now in hand will increase the area of the works from 337,000 square feet to nearly 500,000 square feet, to permit a proportional increase in output.